Appendix B

Technical note: Biodiversity

M1 PACIFIC MOTORWAY WIDENING: TUGGERAH TO DOYALSON

Technical note: Biodiversity investigations for Supplementary Review of Environmental Factors

DECEMBER 2015

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Introduction

This Technical Note provides a review of the potential biodiversity impacts associated with the proposed design amendments. This review is based on the biodiversity technical study that was prepared for the original Project Review of Environmental Factors (REF) and the proposed design amendments as described in Section 3 of the Supplementary REF. The Technical Note provides additional information to that presented in Section 6.8 of the Supplementary REF.

The review is also informed by surveys carried out on 15 July and 5, 6 and 25 August 2015 and updated database searches (EPBC Act Protected Matters search dated 14 August 2015 and NSW BioNet Wildlife Atlas dated 13 August 2015). The results of additional investigations are provided in detail in the Technical note: Biodiversity (Appendix B).

Table 1 provides a summary of whether the design amendments have the potential to change the biodiversity impacts identified in the original Project REF. Where the design amendments do not generate the potential for changes to biodiversity impacts that design amendment is not discussed further below.

Table 1 Potential for changes to biodiversity impacts

#	Design amendment	Potential for change in impacts?
1	New ancillary sites	Yes – The new ancillary sites would encompass areas not assessed by the original Project REF, resulting in the potential for changes in biodiversity impacts. An assessment of potential impacts has been carried out and is included below.
2	Doyalson Link Road bridge over M1 Pacific Motorway entry ramp	Yes – This design amendment results in an altered vegetation clearance footprint from that assessed in the original Project REF. In addition, a Little Eagle nest was subsequently identified in vegetation proposed to be cleared for the original Project REF at this location, requiring updates to the assessment. An assessment of potential impacts has been prepared and is included below.
3	Widening Sparks Road overbridge	Yes – The widening of the overbridge would result in a change in the location of the construction footprint, although there would not be any increase to the size of the footprint. An assessment of potential impacts has been prepared and is included below.
4	Revised staging strategy and horizontal alignment	Yes – The revised horizontal alignment would require minor additional vegetation clearing. An assessment of potential impacts has been prepared and is included below. The revised staging strategy does not alter the construction impacts identified in the original Project REF as the corresponding areas were already proposed to be cleared as part of the original Project.
5	Revised pavement type	No – The revised pavement type would not result in any additional vegetation clearing. As such, there is no potential for changes in biodiversity impacts.

#	Design amendment	Potential for change in impacts?
6	Revised original Project Boundary	Yes – The revised original Project Boundary (the Proposal Boundary) includes areas of vegetation not assessed in the original Project REF and would also result in reductions in the width of some construction exclusion zones around threatened flora species. An assessment of potential impacts has been prepared and is included below.
7	Wyong River spill containment	No – The construction of the Wyong River spill containment would not result in any additional vegetation clearing. The adjacent exclusion zone (to protect important habitat for threatened fauna connectivity) would be maintained. As such, there is no potential for changes in biodiversity impacts.
8	Landscaped area	Yes – The landscaped area is proposed to be constructed adjacent to (but outside of) a SEPP14 coastal wetland. An assessment of potential impacts has been prepared and is included below.
9	Warnervale Interchange lane/ramp reconfigurations	Yes – The Warnervale Interchange lane/ramp reconfigurations would result in minor changes to clearance areas for vegetation communities. An assessment of potential impacts has been prepared and is included below.
10	Variable message signs (VMSs)	No – The locations proposed for installation of the VMSs would be contained within the original Project Boundary assessed in the original Project REF and would not result in any additional clearing of vegetation or changes to fauna habitat. As such, there is no potential for changes in biodiversity impacts.
11	Directional signs	Yes – The directional signs are located in areas not assessed as part of the original Project REF and would require some minor additional vegetation clearing. An assessment of potential impacts has been prepared and is included below.
12	Revised vertical alignment	No – This design amendment relates to a change in the vertical alignment only and therefore would not alter the biodiversity impacts identified in the original Project REF.

Methodology

Updated database searches

Threatened species database searches were updated to ascertain any additional threatened species identified in the locality since the previous assessment. This included the NSW Bionet Wildlife Atlas (Bionet) (search dated 13 August 2015) and EPBC Protected Matters Search (search dated 14 August 2015). The database search areas were consistent with those conducted for the original Project REF, being a 10 km radius from the Proposal Boundary. The Bionet search included any species records since December 2012. An assessment of the likelihood of each additional species to occur within the Proposal Boundary was carried out using the same methodology outlined in the Biodiversity Technical Report (SMEC 2014) for consistency.

Field investigations

The areas subject to clearing that were not previously assessed in the original Project REF were surveyed by Hyder's ecologists, Jane Rodd, Kate Carroll and Josephine Dessmann on 15 July and 5, 6 and 25 August 2015. Surveys involved:

- Identification of vegetation communities based on vegetation structure and floristics
- Vegetation condition assessment
- Terrestrial fauna habitat assessment
- Direct visual observations of animal activity
- Aural recognition of bird and frog calls
- Searches for indirect evidence of fauna (such as scats, nests, burrows, hollows, tracks, scratches and diggings).

Existing environment

The existing environment was described in Section 6.8.1 of the original Project REF. This was reviewed and is still relevant to the proposed design amendments.

The design amendments would impact some additional areas above those described in the original Project REF. These areas include the ancillary sites identified in Section 3 of the Supplementary REF and additional areas associated with the revised Proposal Boundary.

Vegetation communities

Classification of vegetation communities follows that used for the vegetation mapping of Wyong LGA by Bell and Driscoll (2008), as adopted in the Biodiversity Technical Study for the project by SMEC (2014). Nine different vegetation communities were identified and mapped within the Proposal Boundary (Figures 1a to 1n, Appendix A).

The vegetation communities identified in the additional survey areas, and their equivalent Plant Community Type (PCT) in the NSW Vegetation Information System (VIS) classification database, where applicable, are shown in Table 2.

Table 2 Identified vegetation communities and their equivalent Plant Community Type

Vegetation community (based on Bell and Driscoll 2008)	Plant Community Type (NSW VIS classification database)
Modified Alluvial Floodplain Shrub Swamp Forest (modified)	*Melaleuca nodosa* closed shrubland on alluvium of the Central Coast, Sydney Basin Bioregion
Alluvial Riparian Blackbutt Forest	No clear equivalent
Alluvial Woollybutt – Melaleuca Sedge Forest	Paperbarks – Woollybutt swamp forest on coastal lowlands of the Central Coast
Narrabeen Buttonderry Footslopes Forest	Smooth-barked Apple – Red Bloodwood – Brown Stringybark – Hairpin Banksia heathy open forest of coastal lowlands
Narrabeen Dooralong Spotted Gum – Ironbark Forest	Spotted Gum – Red Ironbark – Grey Gum – shrub – grass open forest of the Lower Hunter
Narrabeen Doyalson Coastal Woodland	Scribbly Gum – Red Bloodwood heathy woodland on the coastal plains of the Central Coast, Sydney Basin
Disturbed: canopy only	N/A
Disturbed regrowth	N/A
Cleared	N/A

Seven of the vegetation communities identified in the Proposal Boundary were also mapped by SMEC (2014) as occurring within the original Project REF Boundary. Vegetation communities not recorded by SMEC (2014) were Modified Alluvial Floodplain Shrub Swamp Forest, which was identified on ancillary sites E5, W8 and W9, and Cleared, which was identified on ancillary sites and within some other additional survey sites, mainly at the road interface.

A description of each vegetation community is provided below.

Modified Alluvial Floodplain Shrub Swamp Forest

Modified Alluvial Floodplain Shrub Swamp Forest was identified at ancillary sites E5 and W9. The vegetation at ancillary site E5 consisted of predominantly native low sedges, herbs and grasses with scattered shrubs, and appeared to be regrowth from previous clearing and continued slashing. Commonly observed native species were *Xanthorrhoea fulva, Ptilothrix deusta, Schoenus apogon* (Fluke Bog-rush)*, Juncus remotiflorus, Microlaena stipoides* (Weeping Grass), *Themeda australis* (Kangaroo Grass), *Melaleuca nodosa* (Prickly-leaved Paperbark), and *Melaleuca thymifolia* (Thyme Honey-myrtle). The exotic grasses *Andropogon virginicus* (Whisky Grass) and *Eragrostis curvula* (African Lovegrass) were abundant in the east of site E5, but exotic cover across most of the patch of modified swamp forest was generally low.

The modified Alluvial Floodplain Shrub Swamp Forest on ancillary site W9 consisted of regrowth *Melaleuca linariifolia, Melaleuca nodosa* and *Eucalyptus robusta* (Swamp Mahogany) growing along modified drainage lines. The ground layer in these patches was grassy and herbaceous, dominated by *Microlaena stipoides, Entolasia stricta, Gahnia clarkei, Dichondra repens, Oplismenus aemulus* (Broad-leaved Basket Grass) and *Pratia purpurascens* (Whiteroot).

Although it has been modified by clearing, the vegetation on both sites broadly meets the criteria for the endangered ecological community Swamp Sclerophyll Forest on Coastal Floodplains of the NSW North Coast, Sydney Basin and South East Corner bioregions.

Alluvial Riparian Blackbutt Forest

Alluvial Riparian Blackbutt Forest was recorded near the northern extent of the Project in association with Wallarah Creek. The vegetation adjoining the creek within the Proposal Boundary comprised a canopy of *Eucalyptus pilularis* (Blackbutt), *Corymbia gummifera* (Red Bloodwood) and *Angophora costata* (Smooth-barked Apple) with a shrubby understorey featuring *Syncarpia glomulifera* (Turpentine), *Glochidion ferdinandi* (Cheese Tree), *Acacia* spp. and *Dodonaea triquetra* (Hopbush). The creek flats adjacent to the culvert supported dense cover of ferns, grasses and *Lomandra longifolia* (Spiny-headed Mat-rush).

Alluvial Woollybutt-Melaleuca Sedge Forest

Alluvial Woollybutt – Melaleuca Sedge Forest is mapped in a large swathe around the central section of the Project, and is associated with poorly drained sites on the coastal lowlands. Only a small area of this vegetation type falls within the additional survey areas, forming the edge of a much larger area of the community extending to the north-west of the freeway. The community in the surveyed area consisted of a canopy of *Eucalyptus longifolia* (Woollybutt) and *Angophora costata* with scattered tall shrubs of *Acacia* spp. and *Melaleuca decora* (White Cloud Tree) and a mesic ground layer of mixed native and exotic ferns, herbs and grasses including the native species *Adianthum aethiopicum* (Common Maidenhair Fern), *Lomandra longifolia, Parsonsia straminea* (Common Silkpod) and *Microlaena stipoides,* and the exotic species *Pellaea viridis* (Green Cliff Brake), *Chloris gayana* (Rhodes Grass), *Setaria parviflora* and *Ipomoea indica* (Blue Morning Glory).

Narrabeen Buttonderry Footslopes Forest

Narrabeen Buttonderry Footslopes Forest forms the dominant community across the northern part of the Proposal This vegetation type was recorded in the additional areas around the Warnervale Interchange, the Doyalson Interchange and in the ancillary sites W8 and W9.

The Narrabeen Buttonderry Footslopes Forest recorded in additional survey areas was characterised by the canopy dominants *Angophora costata, Corymbia gummifera, Eucalyptus capitellata* (Brown Stringybark), with a midstorey typically featuring *Allocasuarina littoralis, Leptospermum polygalifolium* (Tantoon) and *Banksia spinulosa* (Hairpin Banksia). The ground layer is generally grassy and herbaceous with *Entolasia stricta, Imperata cylindrica* (Blady Grass), *Pteridium esculentum* (Bracken), *Lomandra obliqua* and *Mirbelia rubiifolia* (Heathy Mirbelia).

Two areas mapped in the original Project REF as Narrabeen Dooralong Spotted Gum – Ironbark Forest to the east of the existing freeway adjacent to Sparks Road have been reclassified as Narrabeen Buttonderry Footslopes Forest based on canopy dominants observed during ground truthing.

Narrabeen Dooralong Spotted Gum – Ironbark Forest

Narrabeen Dooralong Spotted Gum – Ironbark Forest occurs in the north of the Proposal mostly north of Warnervale Interchange. There is one area of this vegetation type within the footprint of the proposed design amendments, to the south-east of the highway north of the Warnervale Interchange. This area and another area of the community within the Doyalson Interchange was previously surveyed by SMEC (2014).

An additional area of this community was identified along the western boundary of ancillary site W9. The vegetation in this area consisted of a canopy of *Corymbia maculata* (Spotted Gum), *Angophora costata, Eucalyptus resinifera* (Red Mahogany) and some occurrence of *Eucalyptus fibrosa* (Red Ironbark) with a midlayer including *Syncarpia glomulifera* (Turpentine), *Acacia* spp., *Melaleuca* spp. and *Bursaria spinosa* (Blackthorn). The ground layer was grassy and dominated by native grass species such as *Microlaena stipoides, Entolasia stricta, Themeda australis* and *Rytidosperma* sp. There was some occurrence of exotic grasses including *Eragrostis curvula* and *Andropogon virginicus,* which was mainly confined to the edges of the mapped area of Narrabeen Dooralong Spotted Gum – Ironbark Forest.

The Narrabeen Dooralong Spotted Gum – Ironbark Forest on site W9 is consistent with the endangered ecological community Lower Hunter Spotted Gum Ironbark Forest in the Sydney Basin bioregion. The extent of Lower Hunter Spotted Gum – Ironbark Forest in the Proposal Boundary is discussed further below.

Narrabeen Doyalson Coastal Woodland

Narrabeen Doyalson Coastal Woodland occurs at the north-eastern extent of the Proposal adjacent to the Doyalson Road exit ramp. The small area of this vegetation type recorded in the additional survey areas was characterised by a canopy of *Eucalyptus haemastoma* (Broad-leaved Scribbly Gum), *Angophora costata, Angophora floribunda* (Rough-barked Apple) and *Eucalyptus capitellata* with a dense midlayer of *Allocasuarina littoralis.*

Disturbed: Canopy only / Disturbed regrowth

Disturbed: Canopy only consists of areas where understorey structure has been completely or partially removed or modified, such that only native canopy trees remain. These areas mainly comprise disturbed edges on road batters. Some areas mapped as Disturbed: Canopy only include some native shrub and grass growth in the understorey. Disturbed

Regrowth includes areas where there has been regrowth of native and exotic shrubs.

Cleared

Cleared areas were mapped in the Proposal Boundary. These include cleared and mown road verges, areas of exotic-dominated grassland, road pavements and other highly modified areas. In some locations the cleared areas contain occasional scattered trees. This map unit has been excluded from the vegetation calculations.

Threatened ecological communities

Three of the vegetation communities identified in the Proposal Boundary fall wholly or partially within the definition of threatened ecological communities (TECs) listed as Endangered under the TSC Act (Table 3, Figures 2a to 2n in Appendix A).

Table 3 Threatened Ecological Communities identified in the Proposal Boundary

Vegetation community	TEC
Alluvial Riparian Blackbutt Forest	River-flat Eucalypt Forest on Coastal Floodplains of the NSW North Coast, Sydney Basin and South East Corner bioregions
Alluvial Woollybutt – Melaleuca Sedge Forest Alluvial Floodplain Swamp Shrub Forest	Swamp Sclerophyll Forest on Coastal Floodplains of the NSW North Coast, Sydney Basin and South East Corner bioregions
Narrabeen Dooralong Spotted Gum – Ironbark Forest	Lower Hunter Spotted Gum – Ironbark Forest in the Sydney Basin Bioregion

SMEC (2014) identified 3.4 ha of the total 4.6 ha of Narrabeen Dooralong Spotted Gum – Ironbark Forest to be impacted as Lower Hunter Spotted Gum – Ironbark Forest (LHSGIF), based on a review of plot data within the sites and within the REF study area and recent research by Bell (2013) in the locality.

The Narrabeen Dooralong Spotted Gum – Ironbark Forest mapped by Bell and Driscoll (2008) as part of the vegetation mapping of the Wyong LGA is not directly equivalent to the EEC Lower Hunter Spotted Gum – Ironbark Forest, although some areas mapped as this community fall within the definition of the EEC.

Bell (2013) used numerical classification to review the floristic composition of Lower Hunter Spotted Gum-Ironbark Forest, and resolve many of the uncertainties established over ten years of its application in the Hunter region. A new map of the pre-1750 distribution of candidate-LHSGIF was prepared for the Wyong LGA, where traditionally it has not been previously identified. Co-dominance by *Corymbia maculata* and *Eucalyptus fibrosa* has generally been adopted as the key floristic determining feature of the community, and rapid data points were collected to establish the presence of these two canopy species.

Revised mapping of the Lower Hunter Spotted Gum – Ironbark Forest EEC was carried out by Stephen Bell for OEH in 2010. Bell acknowledges in the notes associated with the metadata for the OEH (2010) map that in the Wyong LGA mapping, all spotted gum - ironbark forests were lumped together, but that areas with affinities to LHSGIF need to be extracted. He notes that most of this is completed in the OEH (2010) mapping.

It is proposed to adopt the mapping by Bell for OEH (2010) to define the distribution of Lower Hunter Spotted Gum – Ironbark Forest in the Proposal Boundary, with ground-truthing carried out in the additional survey areas within the Proposal Boundary. This has resulted in some changes to the mapping of this EEC from the original Project REF and Submissions

Report.

Fauna habitat

The following fauna habitats were identified in the Proposal Boundary:

- Open forest
- Swamp forest
- Cleared and disturbed
- Aquatic habitats.

A description of each fauna habitat type is provided below. The distribution of fauna habitat types in the Proposal Boundary are shown on Figures 3a to 3n in Appendix A. SMEC (2014) did not map fauna habitat types separately from vegetation communities.

Open forest

Open forest habitats were identified throughout the Proposal Boundary. This included vegetation at the existing Doyalson Link Road overpass and further north on the M1 Pacific Motorway, Warnervale interchange, Hue Hue Road intersection with Sparks Road and around the northbound service centre. Open forest was also identified at ancillary Sites W8 and W9.

Open forest habitats comprised mature and regenerating eucalypts, including occasional hollow-bearing trees. In areas adjacent to the M1 Pacific Motorway, hollow-bearing trees were infrequent. A higher density of hollow-bearing trees was found at the ancillary sites. Hollow-bearing trees would provide nesting and roosting habitat for a range of fauna species, including threatened species. The mid storey generally comprised a tall shrub layer with flowering native species providing foraging and nesting habitat for arboreal species. Low-growing weeds (e.g. Blackberry) and dense grass cover was common close to the roadside. The groundcover further from the road side contained deep leaf litter, patchy grass cover and fallen timber offering shelter and foraging resources for ground-dwelling fauna. A modified and/or cleared mid and understorey was present in some of this habitat, including for vegetation types Disturbed: Canopy only and Disturbed: Regrowth.

Plate 1 Open forest near Warnervale Interchange

Swamp forest

Swamp forest habitats were identified west of the M1 Pacific Motorway, north of the Warnervale Interchange, north of the northbound service centre and adjacent to the access track at ancillary site E5. Modified swamp forest habitat was identified at ancillary sites E5, W8 and W9. Paperbarks generally dominated the midstorey and occasional eucalypts were present. Modified swamp forest in the ancillary sites contained a disturbed understorey and in some cases, a cleared midstorey and/or canopy with waterlogged groundcover remaining (e.g. ancillary site E5). Modified swamp forest would provide habitat for frogs, waterbirds and, where a midstorey or canopy is present, arboreal fauna. Hollow-bearing trees were identified in swamp forest in ancillary site W9.

The understorey north of Doyalson Link Road was boggy at the time of survey. North of the northbound service centre, forest was waterlogged and large shallow pools of water were present. These sites contained a dense cover of sedges and high volumes of fallen timber providing foraging habitat and shelter for ground-dwelling fauna. Macropod scats and diggings were observed in this habitat.

Plate 2 Swamp forest

Cleared and disturbed

Cleared and disturbed habitats were identified throughout the Proposal Boundary, transitioning between native vegetation and the road.

Cleared and disturbed habitats generally comprised a dense cover of grass, occasional shrubs and trees. This habitat type has limited value for fauna.

Aquatic habitats

The M1 Pacific Motorway intersects Wallarah Creek where it is directed underneath the road via a single tall box culvert. This reach of the waterway is degraded with a highly cleared riparian zone that has been stabilised with modified concrete banks. Some stands of instream emergent aquatic vegetation are present in patches, with scattered shrubs and small trees such as Acacias growing on banks and instream. There is some evidence that cattle in the adjacent paddock enter the waterway on occasion which contributes to the degradation of this reach of the waterway. Drainage lines were identified in the vicinity of the northbound service centre passing through culverts. Large pools were present at the culverts openings and instream emergent and submergent vegetation was present providing habitat for frogs. Sedges and tall shrubs including paperbarks flanked these pools. The drainage lines connect to swamp habitats in adjacent areas. No defined channels were present beyond the immediate vicinity of the culverts. The drainage lines would provide limited fish habitat.

Constructed drainage lines occurred at the back of the existing road batters running parallel to the M1 Pacific Motorway, on the western boundary of ancillary site W8 and through the middle of ancillary site W9, running north-south. Most of these drainage lines were narrow, shallow channels lined with deep leaf litter and occasional sedges and grasses. Most drainage lines were dry at the time of the site visit and are unlikely to support fish. They would provide limited ephemeral habitat for frogs.

A large offline dam was located at ancillary site W8. Multiple dams were observed in ancillary

site W9. The dams contained snags and dense emergent vegetation as well as open water. Given their lack of connectivity to nearby watercourses the dams would likely support habitat for mobile aquatic fauna such as eels and tortoises.

Plate 3 Drainage line at outlet of culvert

Threatened flora species

Database searches

Eleven additional flora species were identified in the updated searches. The additional threatened species and their conservation status are described in Table 4.

Table 4 Additional threatened flora species identified in updated database searches

Threatened species	EPBC Act status	TSC Act status
Callistemon linearifolius (Netted Bottle Brush)		Vulnerable
Corunastylis sp. Charmhaven (NSW896673)	Critically Endangered	Critically Endangered
Diuris bracteata	Extinct	Endangered
Epacris purpurascens var. purpurascens		Vulnerable
Eucalyptus oblonga population at Bateau Bay, Forresters Beach and Tumbi Umbi in the Wyong LGA		Endangered Population
Genoplesium baueri (Yellow Gnat Orchid)	Endangered	Endangered
Genoplesium insignis (Variable Midge Orchid)	Critically Endangered	Endangered
Hibbertia procumbens (Spreading Guinea Flower)		Endangered
Persicaria elatior (Tall Knotweed)	Vulnerable	Vulnerable

Threatened species	EPBC Act status	TSC Act status
Senna acclinis (Rainforest Cassia)		Endangered
Thesium australe (Austral Toadflax)	Vulnerable	Vulnerable

An assessment of the likelihood of each species to occur within the Proposal Boundary is provided in Appendix B. All of the additional threatened flora species were assessed to have a low likelihood of occurrence within the Proposal Boundary.

Field assessment

Two threatened flora species were recorded within the Proposal Boundary, on ancillary sites W8 and W9 (Table 5, Figures 3a to 3n).

Table 5 Threatened flora species identified in additional surveys

Threatened species	EPBC Act status	TSC Act status	Location in the surveyed areas
Angophora inopina Charmhaven Apple	Vulnerable	Vulnerable	Two isolated paddock trees of this species were recorded within cleared and disturbed land in the centre of ancillary site W8. Another tree was recorded on the western boundary of site W8. Two additional trees of *Angophora inopina* were identified adjoining the western side of the access road to site E5.
Melaleuca biconvexa Biconvex Paperbark	Vulnerable	Vulnerable	A stand of *Melaleuca biconvexa* was recorded in the south of ancillary site W9 in association with a drainage line.

Threatened fauna species

Database searches

Forty additional fauna species including threatened and migratory species under the TSC Act and/or EPBC Act were identified in the updated database searches. The additional threatened/migratory species and their conservation status are described in Table 6.

Table 6 Additional threatened and migratory fauna species identified in updated database searches

Threatened species	EPBC Act status	TSC Act status
Barking Owl (*Ninox connivens*)		Vulnerable
Black falcon (*Falco subniger*)		Vulnerable
Broad-billed Sandpiper (*Limicola falcinellus*)	Migratory	Vulnerable
Brown Treecreeper (eastern subpecies) (*Climacterus victoriae picumnus*)		Vulnerable
Bush Stone-curlew (*Burhinus grallarius*)		Endangered
Cattle Egret (*Ardea ibis*)	Migratory	
Comb-crested Jacana (*Irediparra gallinacea*)		Vulnerable
Eastern Bristlebird (*Dasyornis brachypterus*)	Endangered	Endangered
Eastern cave Bat (*Vespadelus troughtoni*)		Vulnerable
Eastern Chestnut Mouse (*Pseudomys gracilicaudatus*)		Vulnerable
Eastern Osprey (*Pandion cristatus*)	Migratory	Vulnerable
Eastern Pygmy-possum (*Cercartetus nanus*)		Vulnerable
Flame robin (*Petroica phoenicea*)		Vulnerable
Flesh-footed Shearwater (*Ardenna carneipes*)	Migratory	Vulnerable
Gang-gang Cockatoo (*Callocephalon fimbriatum*)		Vulnerable
Giant Dragonfly (*Petalura gigantea*)		Endangered
Golden-tipped Bat (*Kerivoula papuensis*)		Vulnerable
Gould's Petrel (*Pterodroma leucoptera leucoptera*)	Endangered	Vulnerable
Great Egret (*Ardea alba*)	Migratory	
Greater Sand Plover (*Charadrius leschenaultii*)	Migratory	Vulnerable
Grey-crowned Babbler (eastern subspecies) (*Pomatostomus temporalis temporalis*)		Vulnerable
Kermadec Petrel (*Pterodroma neglecta neglecta*)	Vulnerable	Vulnerable
Little Tern (*Sternula albifrons*)	Migratory	Endangered
Pale-headed Snake (*Hoplocephalus bitorquatus*)		Vulnerable
Parma Wallaby (*Macropus parma*)		Vulnerable
Pectoral Sandpiper (*Calidris melanotos*)	Migratory	
Pied Oystercatcher (*Haematopus longirostris*)		Endangered
Pin-tailed Snipe (*Gallinago stenura*)	Migratory	
Rose-crowned Fruit-Dove (*Ptilinopus regina*)		Vulnerable
Ruddy Turnstone (*Arenaria interpres*)	Migratory	
Scarlet Robin (*Petroica boodang*)		Vulnerable
Sooty Oystercatcher (*Haematopus fuliginosus*)		Vulnerable
Southern Brown Bandicoot (*Isoodon obesulus obesulus*)	Endangered	Endangered

Threatened species	EPBC Act status	TSC Act status
Speckled Warbler (*Chthonicola sagittata*)		Vulnerable
Square-tailed Kite (*Lophoictinia isura*)		Vulnerable
Stephens' Banded Snake (*Hoplocephalus stephensii*)		Vulnerable
Superb Fruit-Dove (*Ptilinopus superbus*)		Vulnerable
Swinhoe's Snipe (*Gallinago megala*)	Migratory	
White-fronted Chat (*Epthianura albifrons*)		Vulnerable
Wompoo Fruit-Dove *Ptilinopus magnificus*		Vulnerable

An assessment of the likelihood of each species to occur within the Proposal Boundary is provided in Appendix B. All migratory listed species were searched on the Atlas of Living Australia to identify any records within 10 km of the Proposal Boundary to assist in this assessment.

The following 14 threatened fauna species were assessed to have a high likelihood of occurrence in the Proposal Boundary:

- Barking Owl
- Brown Treecreeper
- Bush Stone-curlew
- Cattle Egret
- Eastern Chestnut Mouse
- Eastern Osprey
- Eastern Pygmy Possum
- Gang-gang Cockatoo
- Golden-tipped Bat
- Great Egret
- Pale-headed Snake
- Scarlet Robin
- Southern Brown Bandicoot
- Square-tailed Kite.

One species, Rose-crowned Fruit-Dove, was assessed to have a moderate likelihood of occurrence in the Proposal Boundary. All other species were assessed as having a low likelihood of occurrence.

Field assessment

Ecologically sensitive features identified within the Proposal Boundary include hollow bearing trees providing potential habitat for threatened species including Squirrel Glider, Eastern Pygmy Possum, woodland birds, microbats and owls. A Little Eagle nest was identified in vegetation proposed to be cleared in the original Project REF at the Doyalson Link Road interchange.

Furthermore, SEPP 14 wetlands have been mapped adjacent to the eastern side of the M1 Pacific Motorway (Figure 4 in Appendix A). The wetlands contain swamp forest and would provide habitat for a range of fauna, including threatened species. These wetlands are located outside the Proposal Boundary.

Ecologically sensitive features identified within the ancillary sites include:

- Raptor nest potentially of the Little Eagle *Hieraaetus morphnoides* (Vulnerable under the TSC Act) on ancillary site W9 - The raptor nest identified at ancillary site W9 was a large stick nest which, based on its dimensions, structure and materials, could be constructed by a number of raptors, including the Little Eagle. As a precaution, this assessment has considered a worst case scenario and assumed that this nest could be inhabited by a

Little Eagle breeding pair.

- Potential Koala habitat (Vulnerable under the TSC and EPBC Acts) on ancillary sites W8 and W9 – Potential Koala habitat was identified in vegetation that contained Koala feed trees that made up at least 15% of canopy species. *Eucalyptus robusta* (Swamp Mahogany) and *E. resinifera* (Red Mahogany) were identified in densities of at least 15% of the canopy in some locations within the two ancillary sites. *E. robusta* is listed on schedule 2 of SEPP 44 and is listed by OEH as a primary feed tree in the Central Coast Koala Management Area. *E. resinifera* is listed as a secondary feed tree in the Central Coast Koala Management Area. Potential Koala habitat is mapped in Figures 3a to 3n, Appendix A.
- Hollow bearing trees providing potential habitat for threatened species including Squirrel Glider, Eastern Pygmy Possum, woodland birds, microbats and owls at ancillary sites W8 and W9 – Hollows of various sizes were identified during field surveys. The locations of ecologically sensitive features identified within the Proposal Boundary, including hollow-bearing trees, are mapped in Figures 3a to 3n, Appendix A.

Potential impacts

Construction

This section discusses the impacts of each of the relevant design amendments. The cumulative change to vegetation clearing (including to EECs) is presented quantitatively at the end of this section.

Where the design amendments are likely to alter the predicted impacts on threatened species with a moderate or high likelihood of occurrence on site, Assessments of Significance prepared for the original Project REF have been revised to reflect the cumulative potential impacts resulting from the Proposal (Appendix C). These assessments confirmed that significant impacts are unlikely.

Ancillary sites

As outlined in Section 3 of the Supplementary REF, three additional ancillary sites are proposed, being sites W8, W9 and E5. The use of these sites would involve direct and indirect ecological impacts, both of which were taken into account as part of the options evaluation for ancillary sites (refer to Section 2.4.1 of the Supplementary REF).

Direct impacts would include clearing of native vegetation, with more than half of the vegetation to be cleared mapped as Disturbed: canopy only. Specific impacts associated with vegetation clearing would include:

- Removal of some small areas of the threatened ecological communities Lower Hunter Spotted Gum – Ironbark Forest in the Sydney Basin Bioregion and Swamp Sclerophyll Forest on Coastal Floodplains of the NSW North Coast, Sydney Basin and South East Corner bioregions, both listed as Endangered under the TSC Act.
- Removal of two isolated trees of *Angophora inopina*, listed as a Vulnerable species under the TSC Act and EPBC Act, on ancillary site W8.
- Removal of mature trees and some hollow-bearing trees, resulting in the loss of foraging, shelter and breeding resources for a range of fauna species. In total, 12 hollow bearing trees would be removed, including seven located on the additional ancillary site and five within the Proposal Boundary. The loss of hollow-bearing trees would impact breeding habitat of hollow-dependent fauna and would exacerbate the loss of this resource across the landscape. The loss of hollow-bearing trees is a key threatening process under the TSC Act and EPBC Act.

Indirect impacts may include disturbance to fauna from increased activity and noise associated with movement of construction vehicles and from machinery used within these sites (in particular concrete reprocessing and asphalt batching plants). Noise impacts and increased activity may impact fauna species nesting or roosting within the sites. This includes the potential Little Eagle nest on ancillary site W9 which is proposed to be retained on the site. There is potential that the ancillary site establishment could lead to abandonment

of the nest for the duration of the construction period, and potentially beyond. However, the ancillary site would be established outside the breeding period of the Little Eagle to minimise the disruption to the breeding cycle of this species, if it is utilising this nest. In addition, a 90 metre exclusion zone would be established around the nest.

Increased noise and ancillary activities could also impact fauna inhabiting retained hollow-bearing trees and lead to breeding failure or abandonment. As such, retained hollow-bearing trees would have a 10 m exclusion zone to minimise potential impacts.

The original Project REF identified that there would be no potential impacts to native vegetation on the Hue Hue Road ancillary site. In order to provide vehicle access to the ancillary site from the southern boundary, it is proposed to clear a small amount (0.03 ha) of Alluvial Woollybutt-Melaleuca Sedge Forest, which is included within the Swamp Sclerophyll Forest TEC. This area has been incorporated into the vegetation clearing calculations.

Doyalson Link Road bridge over the M1 Pacific Motorway

Construction of the Doyalson Link Road bridge over M1 Pacific Motorway entry ramp requires an altered clearance footprint to accommodate this design amendment. Following determination of the original Project REF, a Little Eagle nest was identified in vegetation proposed to be cleared for the original Project REF at the Doyalson Link Road interchange. Removal of this nest is proposed to occur prior to the onset of the breeding season to avoid brooding failure or nest abandonment. An updated Assessment of Significance for the Little Eagle has been included in Appendix C.

Widening Sparks Road overbridge

The Proposal would widen the Sparks Road overbridge to incorporate a pedestrian path and cycleway (rather than constructing a separate pedestrian cycleway as proposed in the original Project REF). The construction footprint is generally the same size as proposed under the original Project REF however it is in a slightly different location (i.e. immediately adjacent to the existing bridge instead of slightly north of it). The potential change in clearing impacts have been accounted for in the overarching clearing calculations carried out for the Proposal.

Revised horizontal alignment

The revised horizontal alignment would result in minor changes to clearance areas for vegetation communities. The potential change in clearing impacts have been accounted for in the overarching clearing calculations carried out for the Proposal.

Revised original Project Boundary

The revised original Project Boundary would result in some additional vegetation clearing to that identified and assessed within the original Project REF. In addition, the revised original Project Boundary results in areas where three of the 25 m radius exclusion zones for threatened plants proposed in the REF Submissions Report would be unachievable. The exclusion zones have been reduced, however no threatened flora species would be directly impacted as a result of this change and the revised exclusion zones provide a sufficient level of protection for these species.

The revised original Project Boundary would also result in the removal of mature trees and some hollow-bearing trees, resulting in the loss of foraging, shelter and breeding resources for a range of fauna species. In total, five hollow-bearing trees would be removed within the footprint of the revised Project Boundary.

Wyong River spill containment

The construction of the Wyong River spill containment involves work adjacent to the riparian vegetation of Wyong River. This vegetation is part of an exclusion zone to protect important habitat for threatened fauna connectivity. Construction works would not encroach into this exclusion zone which is consistent with the original Project REF.

Landscaped area

The landscaped area is proposed to be constructed adjacent to (but outside of) a SEPP14 coastal wetland. Installation of the landscaped area has the potential to indirectly impact this sensitive ecological community through erosion and sedimentation during construction. As outlined in Section 3 of the Supplementary REF, the materials selected for the landscaped area would be restricted to virgin excavated natural material (VENM), excavated natural material (ENM) and suitable topsoil to minimise the potential for contaminants to enter the wetland. With the implementation of the safeguards and management measures outlined in Section 6.8.3 of the Supplementary REF, the Proposal is unlikely to result in any impacts to the SEPP 14 wetland.

Warnervale Interchange Lane/Ramp Reconfigurations

The Warnervale Interchange Lane/Ramp Reconfigurations would result in minor changes to clearance areas for vegetation communities.

Directional signage

About 53 square metres of the native vegetation community Narrabeen Doyalson Coastal Woodland is mapped by Bell (2008) within part of the footprint for the northernmost proposed directional sign. The site was not subject to field investigation. This vegetation type does not fall within the definition of any threatened ecological communities.

Operation

Design amendments which would have potential additional operational impacts are discussed below.

The original Project REF included the revegetation of the medians following construction as part of the assessment of impacts. The narrowing of the medians as part of the Proposal reduces the area available for revegetation and some sections of the median would not be revegetated. The impact of no vegetation in the median or a reduced area of revegetation would have minimal impacts to fauna connectivity and is relatively consistent with the impacts assessed within the original Project REF.

Wyong River spill containment provides increased protection to the water quality of Wyong River through the interception of potential contaminants entering the waterbody from the bridge. The operational outcomes resulting from this design amendment on biodiversity are positive with increased security of water quality within the Wyong River.

The design of the landscaped area may result in very minor shading of a small area of wetland vegetation, locally altered hydrological regimes and encroachment closer to the boundary of the wetlands. The Proposal would ensure that there are no adverse impacts on water quality or flow regime which could impact the adjacent wetlands during operation.

Summary of impacts across the project

Impacts to native vegetation

Impacts to native vegetation as a result of the Proposal have been calculated by measuring the extent of mapped vegetation communities within the revised original Project Boundary and ancillary sites and subtracting the area of mapped vegetation within the construction exclusion zones (Table 7). The total area of native vegetation to be cleared is 24.37 ha, representing a net increase of 5.07 ha from the 19.3 ha assessed in the original Project REF and Submissions Report.

The areas of most vegetation communities to be cleared have generally increased, however

for some vegetation communities there has been a decrease. This is associated with reclassification of some vegetation communities within the Proposal Boundary and adjacent areas following ground truthing of areas not accessible during field surveys for the Project REF as well as changes in the extent of construction exclusion zones.

Table 7 Impacts to vegetation communities

Vegetation community	Original Project REF impacts (ha)	Total revised impacts (ha)	Change (ha)
Alluvial Bluegum-Paperbark Mesic Palm Forest	0.02	0.08	+0.06
Modified Alluvial Floodplain Shrub Swamp Forest	0	0.04	+0.04
Alluvial Redgum Footslopes Forest	0.66	0.66	0
Alluvial Riparian Blackbutt Forest	0	0.18	+0.18
Alluvial Woollybutt-Melaleuca Sedge Forest	1.45	0.54	-0.91
Narrabeen Buttonderry Footslopes Forest	4.43	8.41	+3.98
Narrabeen Coastal Blackbutt Shrubby Forest	0.34	0.02	-0.32
Narrabeen Dooralong Spotted Gum-Ironbark Forest	6.1	4.36	-1.74
Narrabeen Doyalson Coastal Woodland	0.41	1.65	+1.24
Riverine Alluvial Gallery Rainforest-Moist Forest	0	0.09	+0.09
Disturbed: Canopy only	5.64	7.45	+1.81
Disturbed: Regrowth	0.25	0.89	+0.64
Total native vegetation	**19.3**	**24.37**	**+5.07**

Impacts to threatened ecological communities

Impacts to threatened ecological communities as a result of the Proposal are shown in Table 8. There has been a slight reduction in the area of TECs cleared from that identified in the original Project REF, partially as a result of the reclassification of some areas of Narrabeen Spotted Gum Ironbark Forest and Lower Hunter Spotted Gum – Ironbark Forest.

Table 8 Impacts to threatened ecological communities

Endangered Ecological Community	Original Project REF impacts (ha)	Total revised impacts (ha)	Change (ha)
Lower Hunter Spotted Gum – Ironbark Forest in the Sydney Basin Bioregion	4.9	4.09	-0.81
River-flat Eucalypt Forest on Coastal Floodplains of the NSW North Coast, Sydney Basin and South East Corner	1.01	1.01	0

Endangered Ecological Community	Original Project REF impacts (ha)	Total revised impacts (ha)	Change (ha)
bioregions			
Swamp Sclerophyll Forest on Coastal Floodplains of the NSW North Coast, Sydney Basin and South East Corner bioregions	1.12	0.57	-0.55
Total	**7.03**	**5.67**	**-1.36**

Assessments of Significance have been prepared to assess impacts to the threatened ecological communities for which impacts have changed:

- Lower Hunter Spotted Gum – Ironbark Forest in the Sydney Basin Bioregion.
- Swamp Sclerophyll Forest on Coastal Floodplains of the NSW North Coast, Sydney Basin and South East Corner bioregions.

The assessments of significance (Appendix C) found that the impacts of the Proposal would not be significant.

Impacts to threatened flora species

The Proposal would have direct impacts on one threatened flora species: *Angophora inopina* (Charmhaven Apple), listed as Vulnerable under the TSC Act and EPBC Act. Two isolated trees of this species growing in cleared land on ancillary site W9 would be removed.

Two other threatened flora species identified in the original Project REF, *Grevillea parviflora* subsp. *parviflora* and *Melaleuca biconvexa,* may be subject to additional indirect impacts as a result of the proposed design amendments. *Melaleuca biconvexa* has been recorded on ancillary site W9 and there have been reductions to the width of some construction exclusion zones adjoining stands of *Grevillea parviflora* subsp. *parviflora.*

The Assessments of Significance prepared by SMEC (2014) for the original Project REF have been updated to assess impacts to threatened flora species for which impacts have changed. These species are listed in Table 9.

Table 9 Threatened flora species for which assessments of significance have been updated

Threatened species	EPBC Act status	TSC Act status
Grevillea parviflora subsp. *parviflora* (Small-flowered Grevillea)	Vulnerable	Vulnerable
Rutidosis heterogama (Heath Wrinklewort)	Vulnerable	Vulnerable
Pimelea curviflora var. *curviflora*	Vulnerable	Vulnerable
Acacia bynoeana (Bynoe's Wattle)	Vulnerable	Endangered
Cryptostylis hunteriana (Leafless Tongue Orchid)	Vulnerable	Vulnerable
Melaleuca biconvexa (Biconvex Paperbark)	Vulnerable	Vulnerable
Angophora inopina (Charmhaven Apple)	Vulnerable	Vulnerable
Tetratheca juncea (Black-eyed Susan)	Vulnerable	Vulnerable
Thelymitra sp. *adorata* (Wyong Sun Orchid)	Critically Endangered	Critically Endangered
Eucalyptus parramattensis subsp. *parramattensis*		Endangered

Threatened species	EPBC Act status	TSC Act status
(Endangered Population)		Population

The updated assessments of significance (Appendix C) found that the impacts of the Proposal would not be significant.

Impacts to fauna habitat

Impacts to fauna habitat as a result of the Proposal have been calculated by measuring the extent of mapped fauna habitats within the revised original Project Boundary and subtracting the area of mapped habitat within the construction exclusion zones (
Table 10). Impacts to fauna habitat were not quantified in the original Project REF and, as such, a direct comparison is not provided.

Table 10 Impacts to fauna habitat

Fauna habitat	Total impacts (ha)
Open Forest	22.88
Swamp Forest	1.49
Cleared and Disturbed	29.89
Total	**54.26**

Further, the Proposal would result in the removal of up to 12 additional hollow-bearing trees, five of which are within the revised original Project Boundary and seven within the ancillary sites. The loss of hollow-bearing trees would result in impacts to foraging, shelter and breeding resources for a range of fauna species including threatened species such as Squirrel Glider, Eastern Pygmy Possum, woodland birds, microbats and owls. However, impacts would not be significant (refer to following paragraph).

Impacts to threatened fauna species

Impacts to threatened and/or migratory fauna species assessed in the original Project REF have changed as a result of additional clearing of vegetation and loss of habitat features (e.g. hollow-bearing trees). As such, the Assessments of Significance prepared in the original Project REF have been updated and provided in Appendix C. The updated Assessments of Significance found that the impacts of the Proposal would not be significant.

Table 11 Threatened flora species for which assessments of significance have been updated

Threatened species	EPBC Act status	TSC Act status
Eastern False Pipistrelle (*Falsistrellus tasmaniensis*)		Vulnerable
Little Bentwing-bat (*Miniopterus australis*)		Vulnerable
Eastern Bentwing-bat (*Miniopterus schreibersii oceanensis*)		Vulnerable
Eastern Freetail-bat (*Mormopterus norfolkensis*)		Vulnerable
Yellow-bellied Sheathtail-bat (*Saccolaimus flaviventris*)		Vulnerable
Greater Broad-nosed Bat (*Scoteanax rueppellii*)		Vulnerable
Regent Honeyeater (*Anthochaera phrygia*)	Critically Endangered	Critically Endangered
Glossy Black-Cockatoo (*Calyptorhynchus lathami*)		Vulnerable
Varied Sittella (*Daphoenositta chrysoptera*)		Vulnerable

Threatened species	EPBC Act status	TSC Act status
Little Lorikeet (*Glossopsitta pusilla*)		Vulnerable
Painted Honeyeater (*Grantiella picta*)	Vulnerable	Vulnerable
Little Eagle (*Hieraaetus morphnoides*)		Vulnerable
Swift Parrot (*Lathamus discolor*)	Endangered	Endangered
Powerful Owl (*Ninox strenua*)		Vulnerable
Masked Owl (*Tyto novaehollandiae*)		Vulnerable
Squirrel Glider (*Petaurus norfolcensis*)		Vulnerable
Koala (*Phascolarctos cinereus*)	Vulnerable	Vulnerable
Grey-headed Flying-fox (*Pteropus poliocephalus*)	Vulnerable	Vulnerable
Wallum Froglet (*Crinia tinnula*)		Vulnerable
New Holland Mouse (*Pseudomys novaehollandiae*)	Vulnerable	

The Proposal could additionally impact on 15 additional threatened and/or migratory fauna species not assessed in the original Project REF (Table 12). Assessments of Significance have been prepared to assess impacts to these threatened and/or migratory fauna species (Appendix C).

Table 12 Additional threatened fauna species for which assessments of significance have been prepared

Threatened species	EPBC Act status	TSC Act status
Barking Owl (*Ninox connivens*)		Vulnerable
Brown Treecreeper (eastern subpecies) (*Climacterus victoriae picumnus*)		Vulnerable
Bush Stone-curlew (*Burhinus grallarius*)		Endangered
Cattle Egret (*Ardea ibis*)	Migratory	
Eastern Chestnut Mouse (*Pseudomys gracilicaudatus*)		Vulnerable
Eastern Osprey (*Pandion cristatus*)	Migratory	Vulnerable
Eastern Pygmy-possum (*Cercartetus nanus*)		Vulnerable
Gang-gang Cockatoo (*Callocephalon fimbriatum*)		Vulnerable
Golden-tipped Bat (*Kerivoula papuensis*)		Vulnerable
Great Egret (*Ardea alba*)	Migratory	
Pale-headed Snake (*Hoplocephalus bitorquatus*)		Vulnerable
Rose-crowned Fruit-Dove (*Ptilinopus regina*)		Vulnerable
Scarlet Robin (*Petroica boodang*)		Vulnerable
Southern Brown Bandicoot (*Isoodon obesulus obesulus*)	Endangered	Endangered
Square-tailed Kite (*Lophoictinia isura*)		Vulnerable

The Assessments of Significance found that the impacts of the Proposal would not be significant.

Conclusion

Overall, the impacts from construction and operation of the Proposal would not significantly alter the biodiversity impacts identified in the original Project REF and, with the implementation of the safeguards and management measures outlined in Section 6.8.3 and Section 7 of the Supplementary REF, are unlikely to significantly impact the environment.

Safeguards and management measures

The biodiversity safeguards and management measures from the original Project REF and Submissions Report have been reviewed and would apply to the proposed design amendments. Additional safeguards and management measures for biodiversity beyond those identified in these documents are outlined in Table 13. Amendments to the measures from the Submissions Report are shown in ~~strikethrough text~~ for deletions and **bold red text** for additions.

Table 13 Additional biodiversity safeguards and management measures

Impact	Environmental safeguards	Responsibility	Timing
Threatened fauna species impact	**The removal of the Little Eagle nest and nest tree near Doyalson Link Road would occur between March and July to avoid the breeding and nesting season (and potential incubation failure or nest abandonment). The nest would be checked prior to removal for signs of use to avoid mortality to young.**	Roads and Maritime	Pre-construction
Threatened fauna species impact	**A delineated exclusion zone of 90 m would be established around the raptor nest on ancillary site W9. Ancillary site establishment would occur outside the nesting period of the Little Eagle to avoid brooding failure or nest abandonment, if this species is utilising this nest.**	Construction contractor Roads and Maritime	Pre-construction, construction
Threatened fauna species impact	**A delineated exclusion zone of 10 m would be established around retained hollow-bearing trees. No ancillary activities would be carried out within the exclusion zones.**	Construction contractor	Pre-construction, construction
Threatened fauna habitat impact	**Where hollow-bearing trees are to be removed, nest boxes would be used to mitigate habitat loss. A nest box strategy would be prepared in accordance with Guide 8 (Nest Boxes) of the *Roads and Maritime Biodiversity Guidelines* (2011).**	Construction contractor	Pre-construction
Fauna injury	**Barbed wire on fencing adjacent to native vegetation would only be used where absolutely necessary. Where use of barbed wire is necessary, consideration would be given to making it more visible to flying and arboreal animals.**	Construction contractor Roads and Maritime	Pre-construction, construction
Aquatic impacts	Exclusion zones (20 m) are to be established around **retained** water	RMS	Pre-construction,

Impact	Environmental safeguards	Responsibility	Timing
	bodies (including creeks and dams).		construction
Impacts on native vegetation/ fauna habitat	Exclusion zones detailed in ~~Figure 1 and Figure 2 of the Submissions Report~~ **Figures 1a to 1n in Appendix A of this technical note** are to be established and maintained throughout construction. Ensure that exclusion zones are fenced off and signage erected in accordance with the Roads and Maritime Biodiversity guidelines: Guide 2 – Exclusion Zones (RTA, 2011).	RMS	Pre-construction, construction
Impacts on native vegetation/ fauna habitat	~~There should be no clearing of any mature trees on construction ancillary sites.~~ There should be no clearing of any mature trees on construction ancillary sites **at the McPherson Road and Warren Road ancillary sites. Clearing of mature trees on the Hue Hue Road ancillary site would be restricted to the area required to provide vehicle access from the service centre (0.03 ha).** **Clearing of mature trees on construction ancillary sites W8, W9 and E5 would be minimised. Where clearing is required pre-clearing and staged clearing procedures would be followed in accordance with Roads and Maritime biodiversity guidelines Guide 4: Clearing of vegetation and removal of bushrock.**	Construction contractor	Pre-construction, construction
Threatened flora species impact	Locations confirmed to contain individuals of threatened flora species, including buffer zones up to 25 m from the individuals of *Tetratheca juncea* or *Grevillea parviflora* subsp. *parviflora* would be exclusion zones **except for the three locations where these buffer zones have been reduced to 5, 15 and 17 m along the M1 Pacific Motorway road shoulder.** ~~Exclusion zones are detailed in Figure 1 and Figure 2 of the Submissions Report.~~ Exclusion zones are to be established prior to construction commencing and maintained throughout construction.	Construction contractor	Pre-construction, construction

Appendix A

Figures

Figures 1a to 1n - Vegetation communities

Note: Construction exclusion zones shown on this map set may relate to threatened species, fauna habitat features or threatened ecological communities. Figures 1a to 1n, 2a to 2n and 3a to 3n map all of these features.

Tuggerah to Doyalson M1 Upgrade Supplementary REF

LEGEND

Directional signs construction footprint

Vegetation community

Narrabeen Doyalson Coastal Woodland

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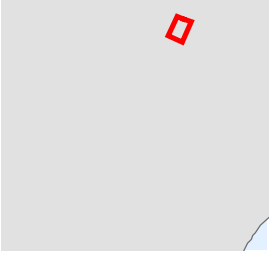

Vegetation communities

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Created by : GC
QA by : KC

Tuggerah to Doyalson M1 Upgrade Supplementary REF

LEGEND

- Directional signs construction footprint
- Proposal Boundary
- Original Project Boundary
- Exclusion zone

Vegetation community

- Alluvial Bluegum-Paperbark Mesic Palm Forest
- Alluvial Riparian Blackbutt Forest
- Cleared
- Narrabeen Buttonderry Footslopes Forest
- Narrabeen Doyalson Coastal Woodland

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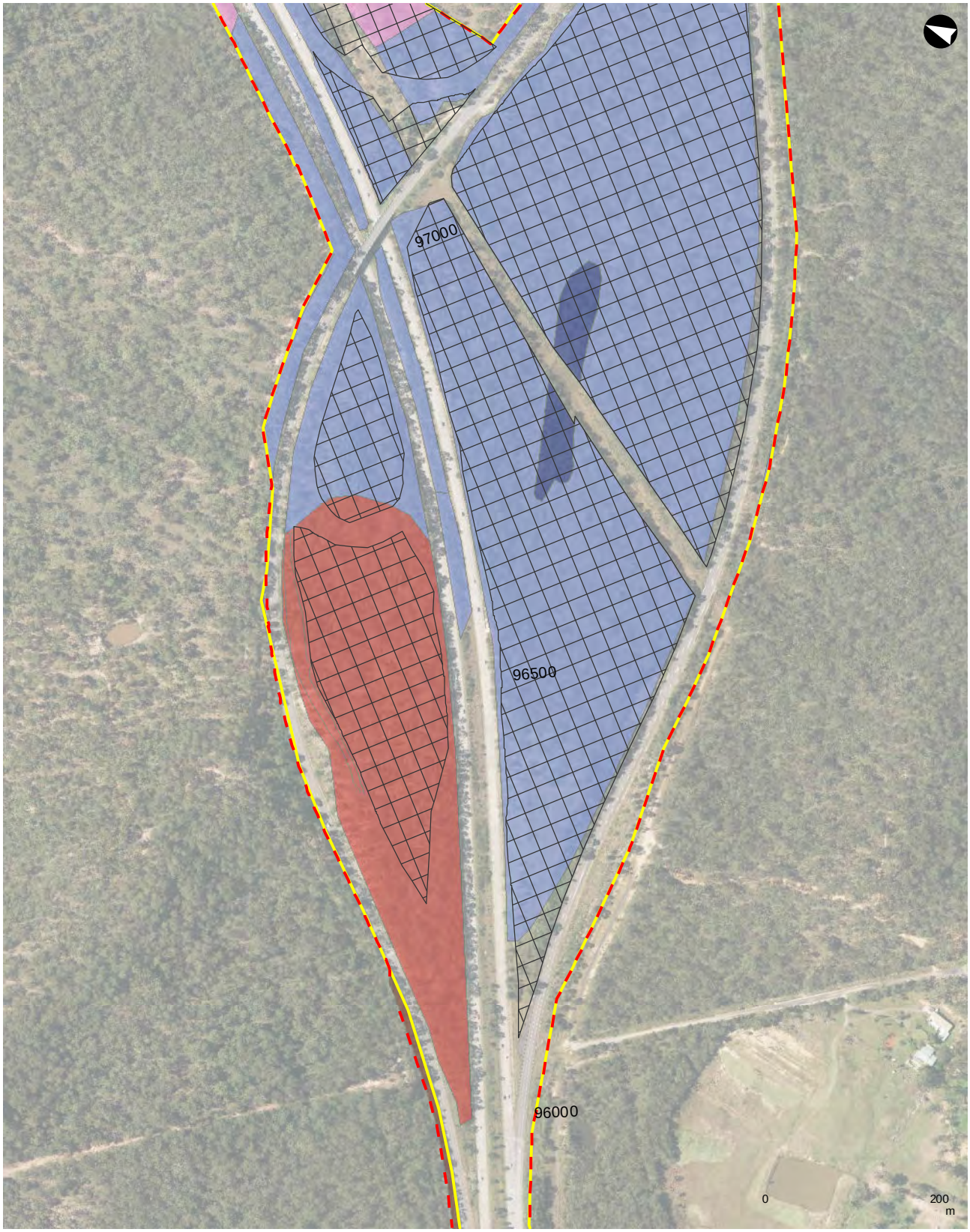
Tuggerah to Doyalson M1 Upgrade Supplementary REF



LEGEND

- Proposal Boundary
- Original Project Boundary
- Exclusion zone

Vegetation community

- Disturbed: Canopy only
- Disturbed: Regrowth
- Narrabeen Buttonderry Footslopes Forest
- Narrabeen Dooralong Spotted Gum-Ironbark Forest
- Narrabeen Doyalson Coastal Woodland
- Narrabeen Impeded Wet Heath

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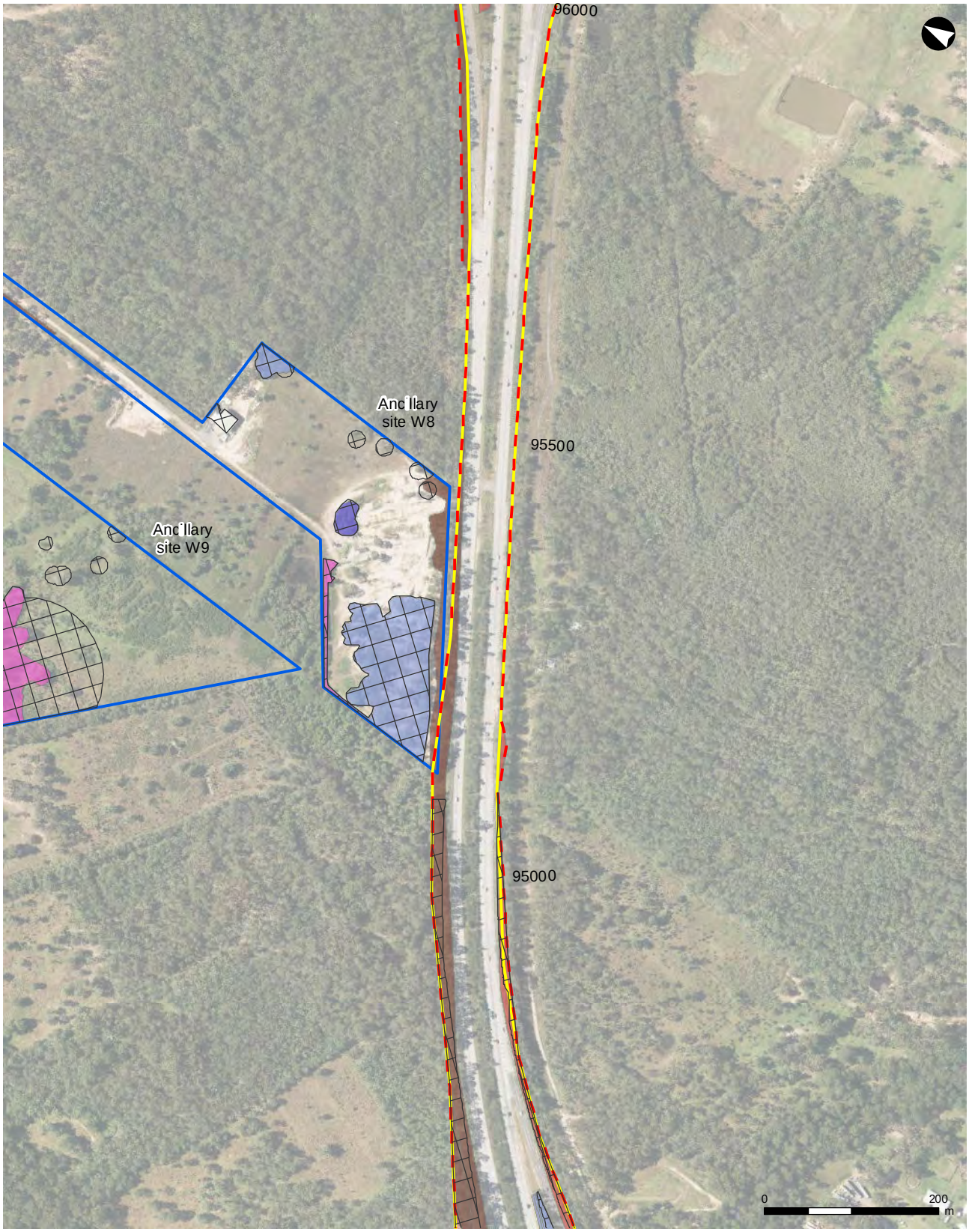
Tuggerah to Doyalson M1 Upgrade Supplementary REF



LEGEND

- Proposal Boundary
- Original Project Boundary
- Proposal ancillary site
- Exclusion zone

Vegetation community

- Alluvial Bluegum-Paperbark Mesic Palm Forest
- Disturbed: Canopy only
- Disturbed: Regrowth
- Modified Alluvial Floodplain Shrub Swamp Forest
- Narrabeen Buttonderry Footslopes Forest
- Narrabeen Dooralong Spotted Gum-Ironbark Forest

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Hyder

NSW Transport Roads & Maritime Services

Vegetation communities

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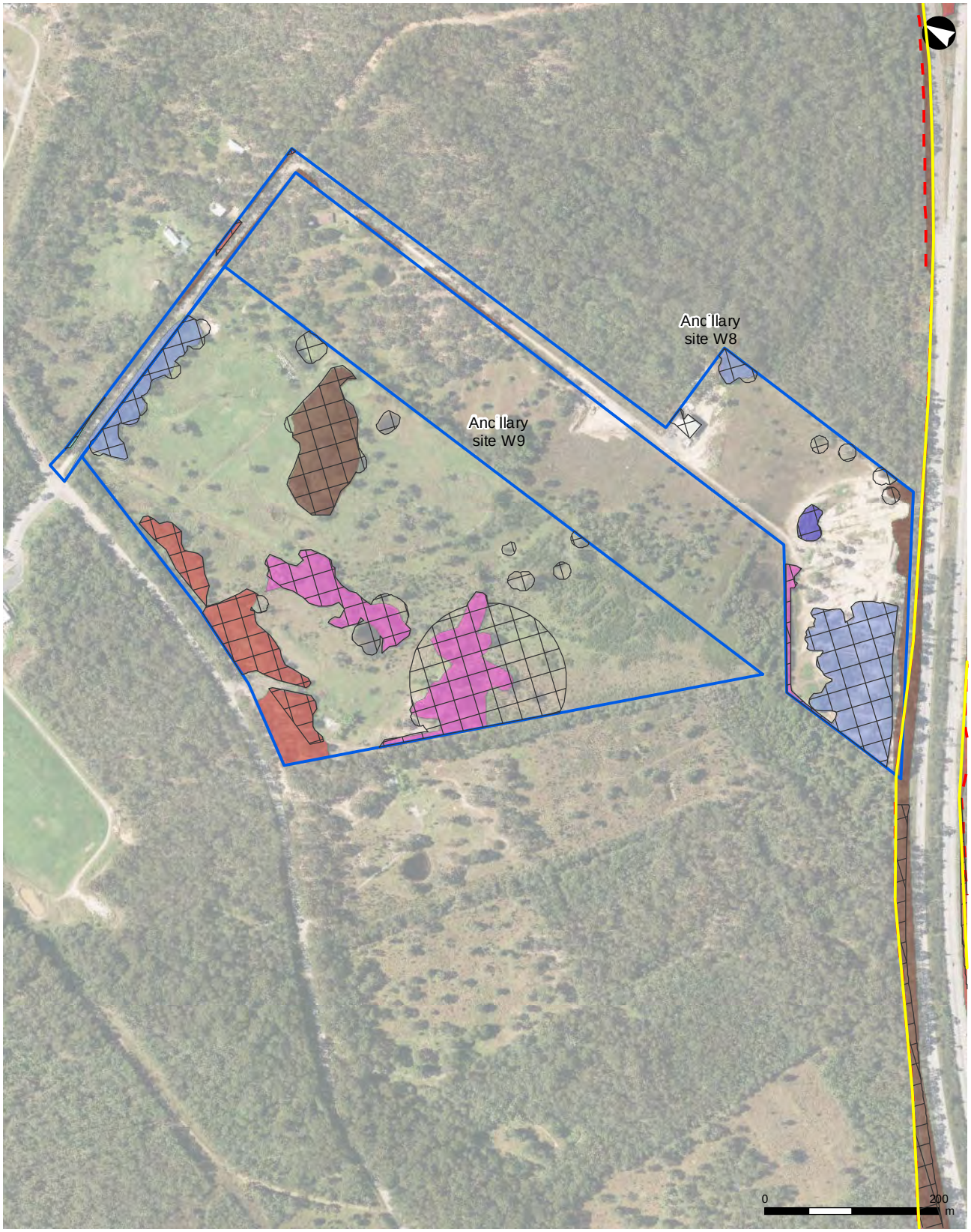
QA by : KC

Tuggerah to Doyalson M1 Upgrade Supplementary REF



LEGEND

- Proposal Boundary
- Original Project Boundary
- Proposal ancillary site
- Exclusion zone

Vegetation community

- Alluvial Bluegum-Paperbark Mesic Palm Forest
- Alluvial Redgum Footslopes Forest
- Disturbed: Canopy only
- Disturbed: Regrowth
- Modified Alluvial Floodplain Shrub Swamp Forest
- Narrabeen Buttonderry Footslopes Forest
- Narrabeen Dooralong Spotted Gum-Ironbark Forest

Vegetation communities

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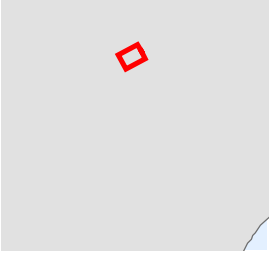
NSW Transport Roads & Maritime Services



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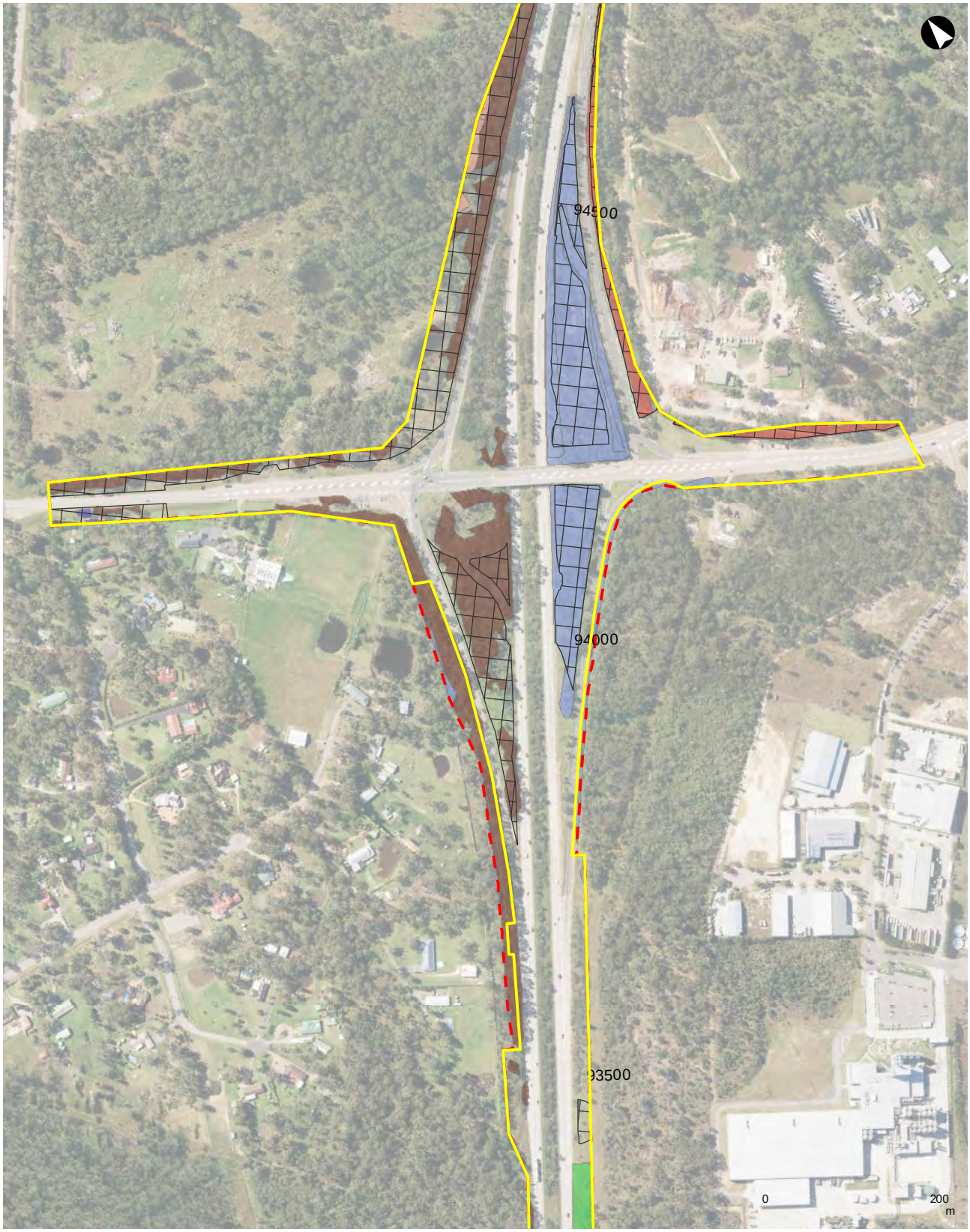
Tuggerah to Doyalson M1 Upgrade Supplementary REF



LEGEND

- Proposal Boundary
- Original Project Boundary
- Exclusion zone

Vegetation community

- Alluvial Bluegum-Paperbark Mesic Palm Forest
- Cleared
- Disturbed: Canopy only
- Disturbed: Regrowth
- Narrabeen Buttonderry Footslopes Forest
- Narrabeen Dooralong Spotted Gum-Ironbark Forest

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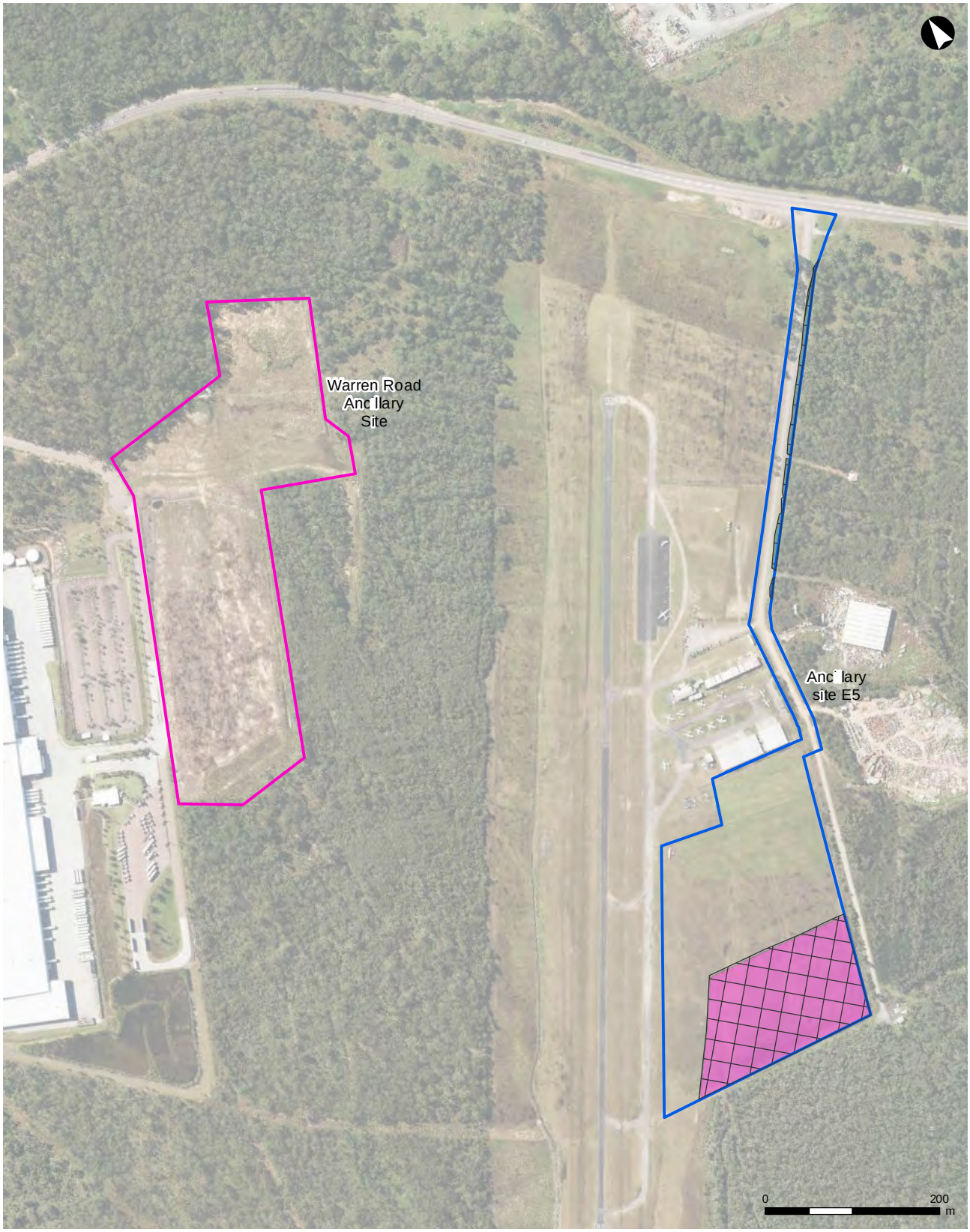
Vegetation communities

Date: 21/12/2015 Path: \\HC-AUS-NS-FS-01\jobs\AA007114\L-GIS\A_Current\B_Maps\SupplementaryREF\Ecology\AA007114_SREF_Ecology_FXXX_VegComms_MB_r1v4.mxd
Created by : GC
QA by : KC

Tuggerah to Doyalson M1 Upgrade Supplementary REF



LEGEND

- Proposal ancillary site
- Project ancillary site
- Exclusion zone

Vegetation community

- Alluvial Woollybutt-Melaleuca Sedge Forest
- Modified Alluvial Floodplain Shrub Swamp Forest

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Vegetation communities

Date: 21/12/2015 Path: \\HC-AUS-NS-FS-01\jobs\AA007114\L-GIS\A_Current\B_Maps\SupplementaryREF\Ecology\AA007114_SREF_Ecology_FXXX_VegComms_MB_r1v4.mxd
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QA by : KC

Tuggerah to Doyalson M1 Upgrade Supplementary REF

LEGEND

- Proposal Boundary
- Original Project Boundary
- Exclusion zone

Vegetation community

- Alluvial Woollybutt-Melaleuca Sedge Forest
- Cleared
- Disturbed: Canopy only

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Vegetation communities

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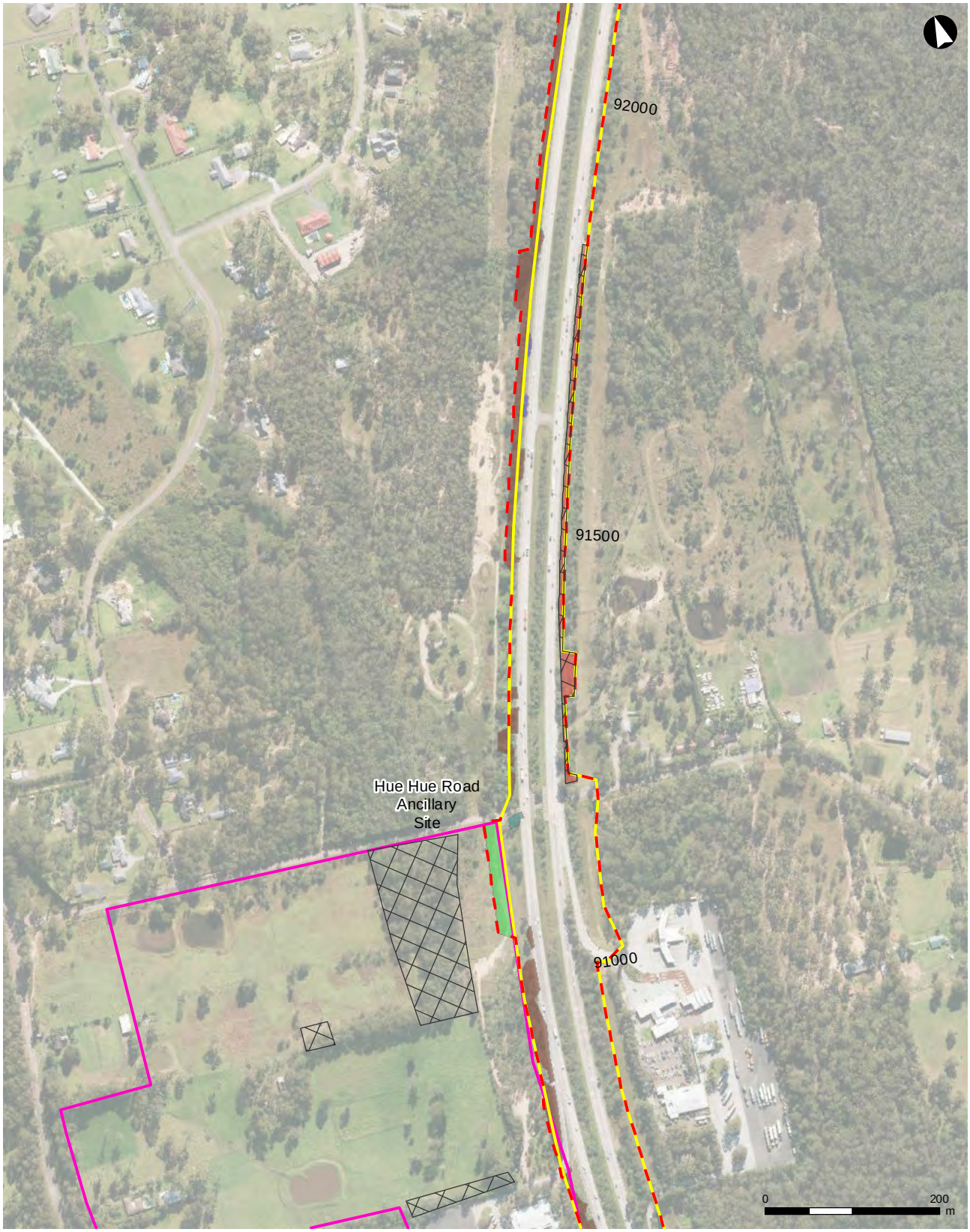
Tuggerah to Doyalson M1 Upgrade Supplementary REF



LEGEND

- Proposal Boundary
- Original Project Boundary
- Project ancillary site
- Exclusion zone

Vegetation community

- Alluvial Woollybutt-Melaleuca Sedge Forest
- Cleared
- Disturbed: Canopy only
- Disturbed: Regrowth
- Narrabeen Dooralong Spotted Gum-Ironbark Forest

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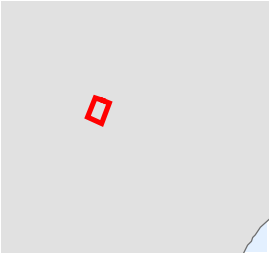

Vegetation communities

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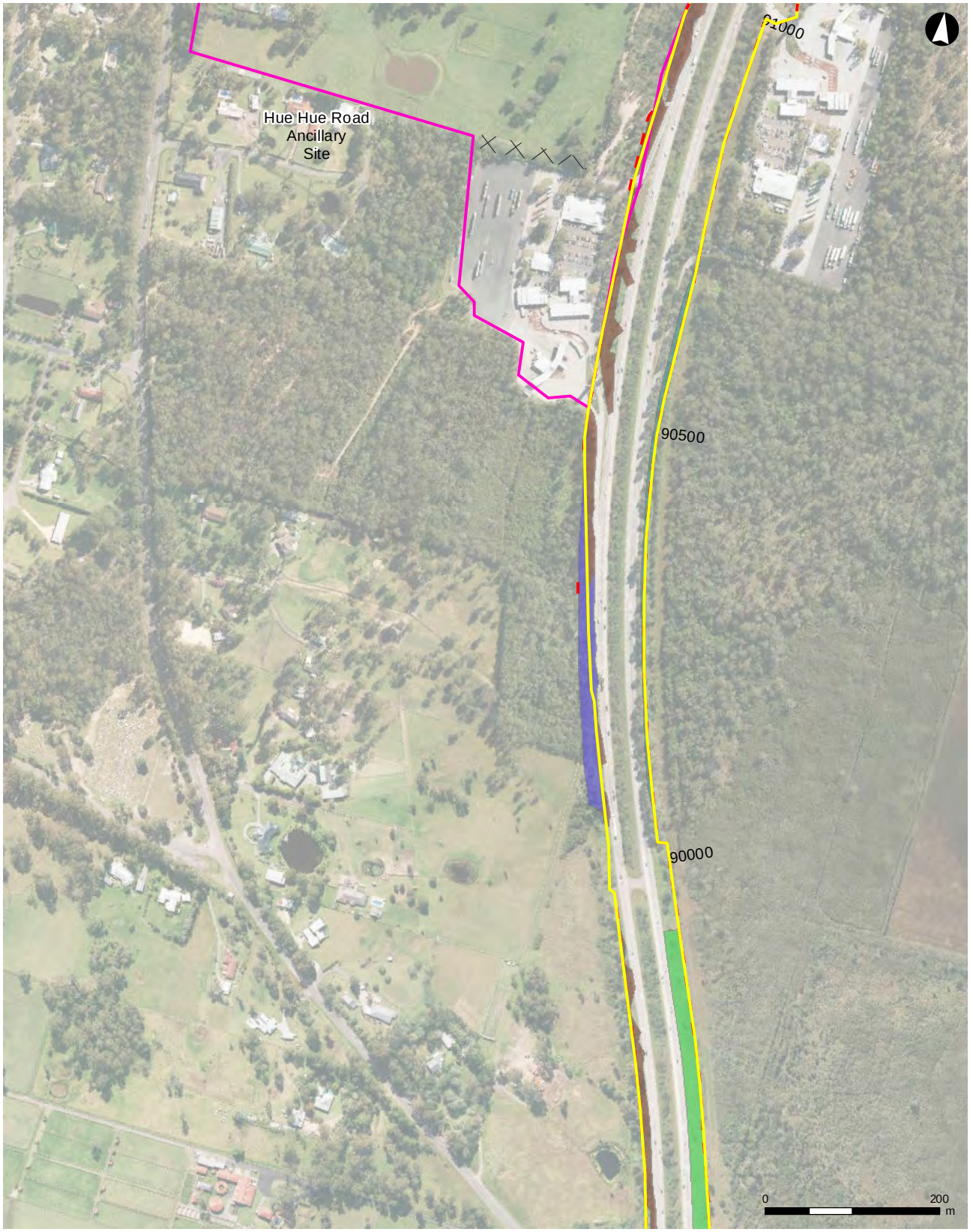
Tuggerah to Doyalson M1 Upgrade Supplementary REF



LEGEND

- Proposal Boundary
- Original Project Boundary
- Project ancillary site
- Exclusion zone

Vegetation community

- Alluvial Woollybutt-Melaleuca Sedge Forest

- Cleared
- Disturbed: Canopy only
- Disturbed: Regrowth

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Vegetation communities

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Tuggerah to Doyalson M1 Upgrade Supplementary REF

LEGEND

- Proposal Boundary
- Original Project Boundary

Vegetation community

- Cleared
- Disturbed: Canopy only
- Disturbed: Regrowth
- Narrabeen Dooralong Spotted Gum-Ironbark Forest

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Vegetation communities

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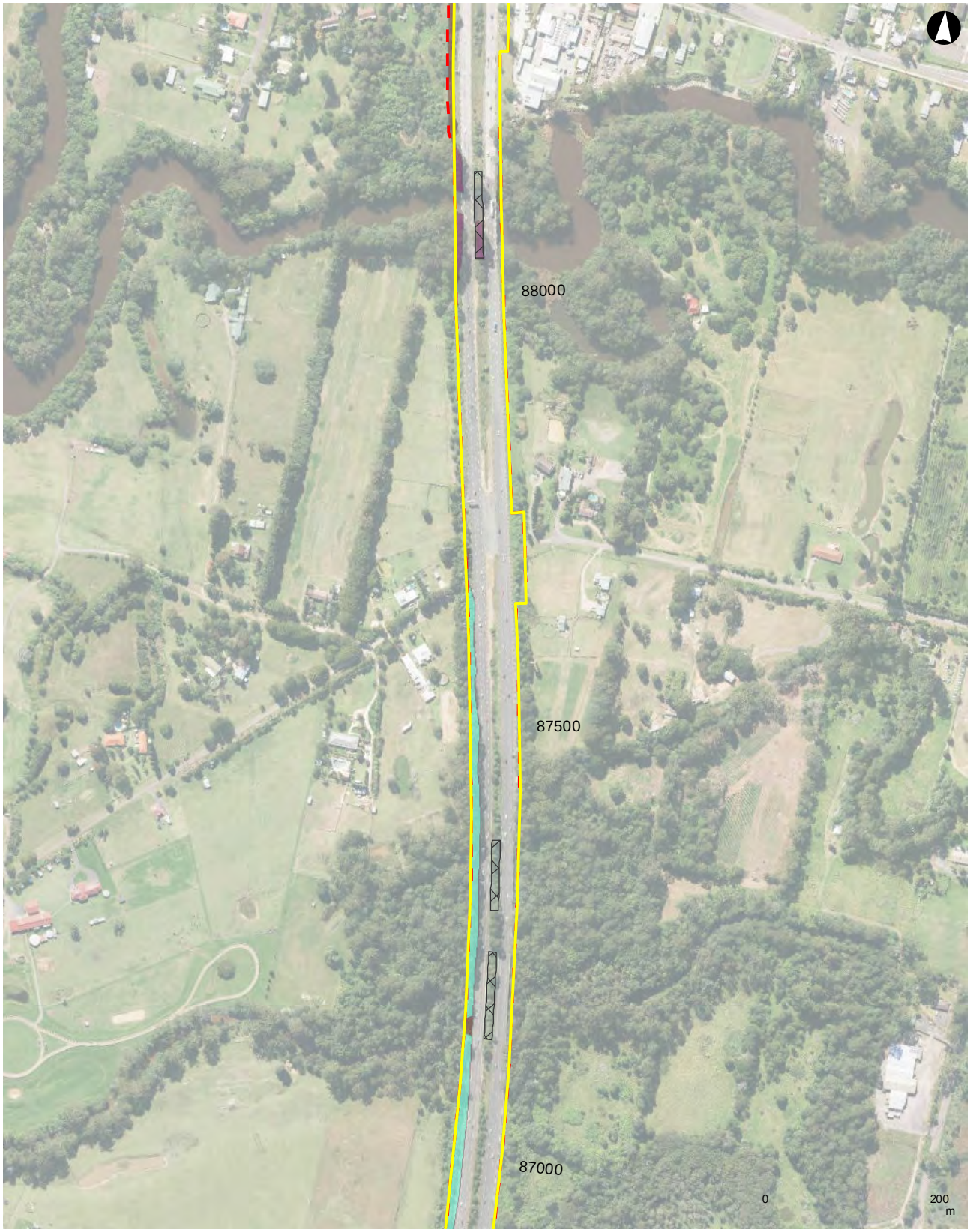

LEGEND

- Proposal Boundary
- Original Project Boundary
- Exclusion zone

Vegetation community

- Alluvial Redgum Footslopes Forest
- Alluvial Riparian Blackbutt Forest
- Disturbed: Canopy only
- Riverine Alluvial Gallery Rainforest-Moist Forest

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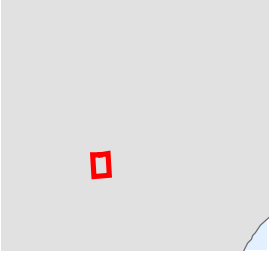

Vegetation communities

Date: 21/12/2015 Path: \\HC-AUS-NS-FS-01\jobs\AA007114\L-GIS\A_Current\B_Maps\SupplementaryREF\Ecology\AA007114_SREF_Ecology_FXXX_VegComms_MB_r1v4.mxd
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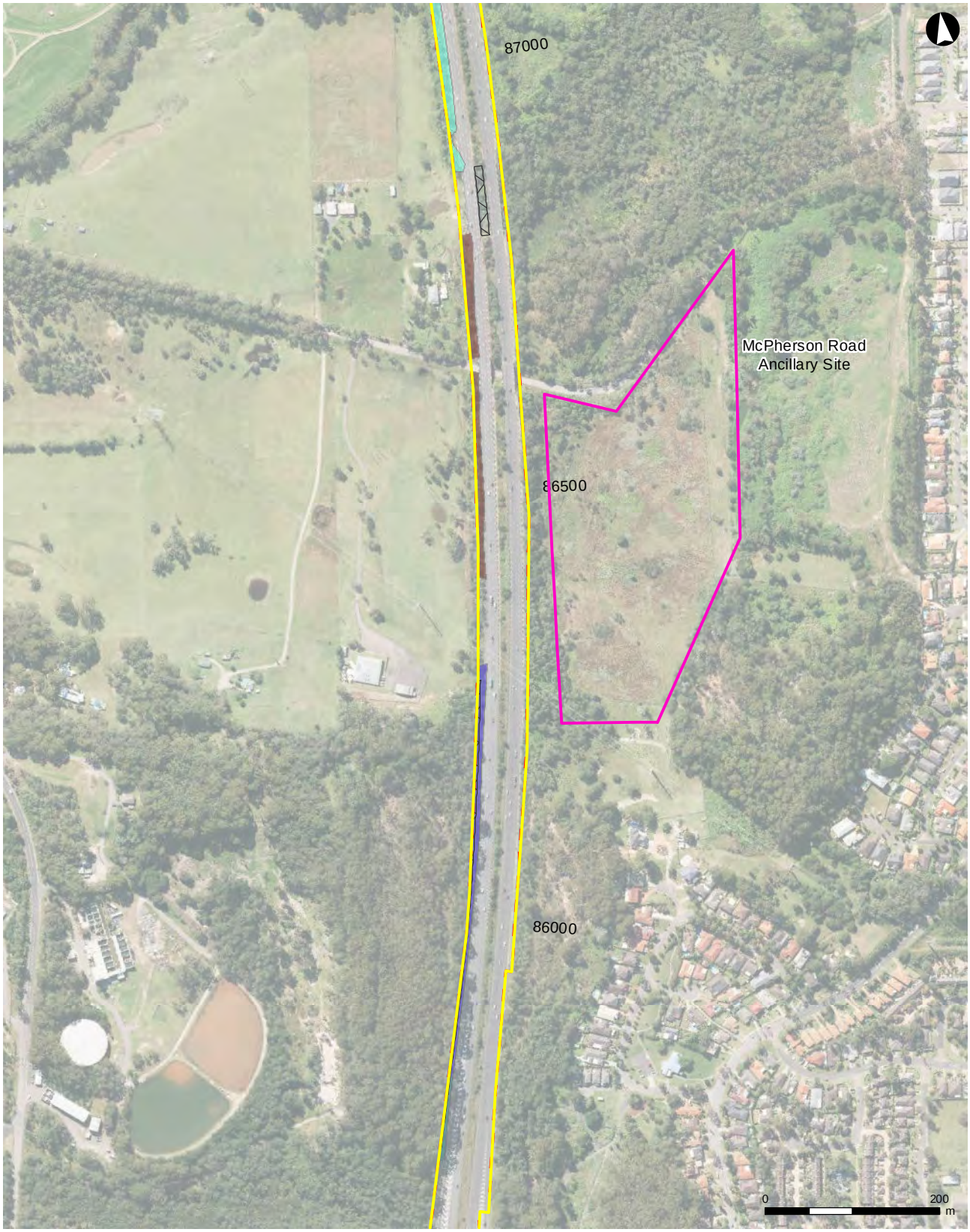
Tuggerah to Doyalson M1 Upgrade Supplementary REF



LEGEND

- Proposal Boundary
- Original Project Boundary
- Project ancillary site
- Exclusion zone

Vegetation community

- Alluvial Redgum Footslopes Forest
- Alluvial Woollybutt-Melaleuca Sedge Forest
- Disturbed: Canopy only
- Disturbed: Regrowth
- Narrabeen Coastal Blackbutt Shrubby Forest
- Riverine Alluvial Gallery Rainforest-Moist Forest

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Vegetation communities

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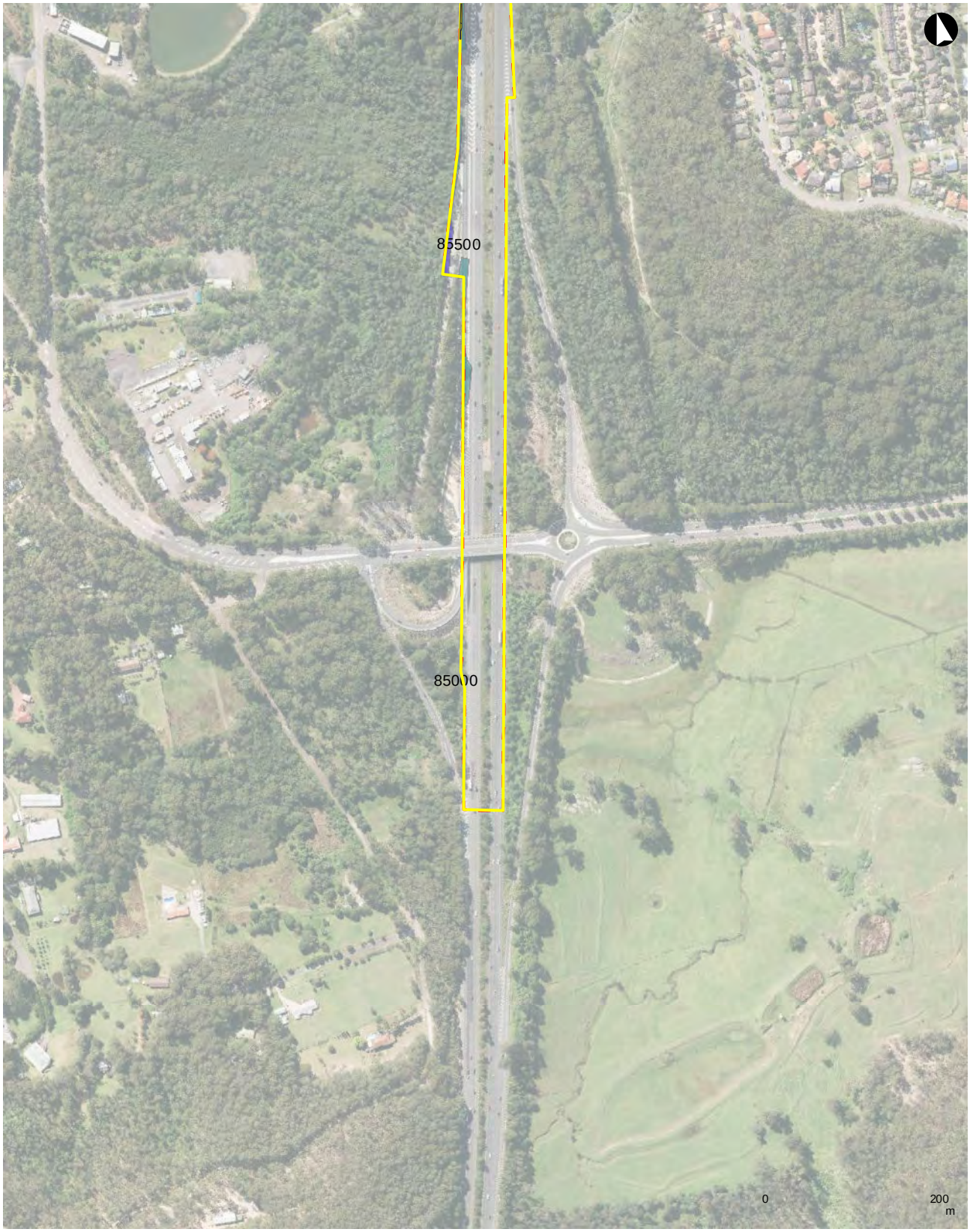
Tuggerah to Doyalson M1 Upgrade Supplementary REF



LEGEND

Proposal Boundary
Original Project Boundary
Exclusion zone

Vegetation community

Alluvial Woollybutt-Melaleuca Sedge Forest

Disturbed: Regrowth

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Figures 2a to 2n - EECs and threatened flora

Note: Construction exclusion zones shown on this map set may relate to threatened species, fauna habitat features or threatened ecological communities. Figures 1a to 1n, 2a to 2n and 3a to 3n map all of these features.

Tuggerah to Doyalson M1 Upgrade Supplementary REF

LEGEND

Directional signs
construction footprint

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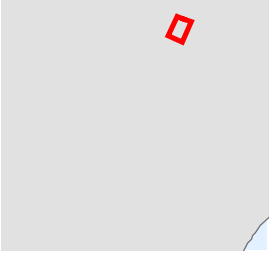
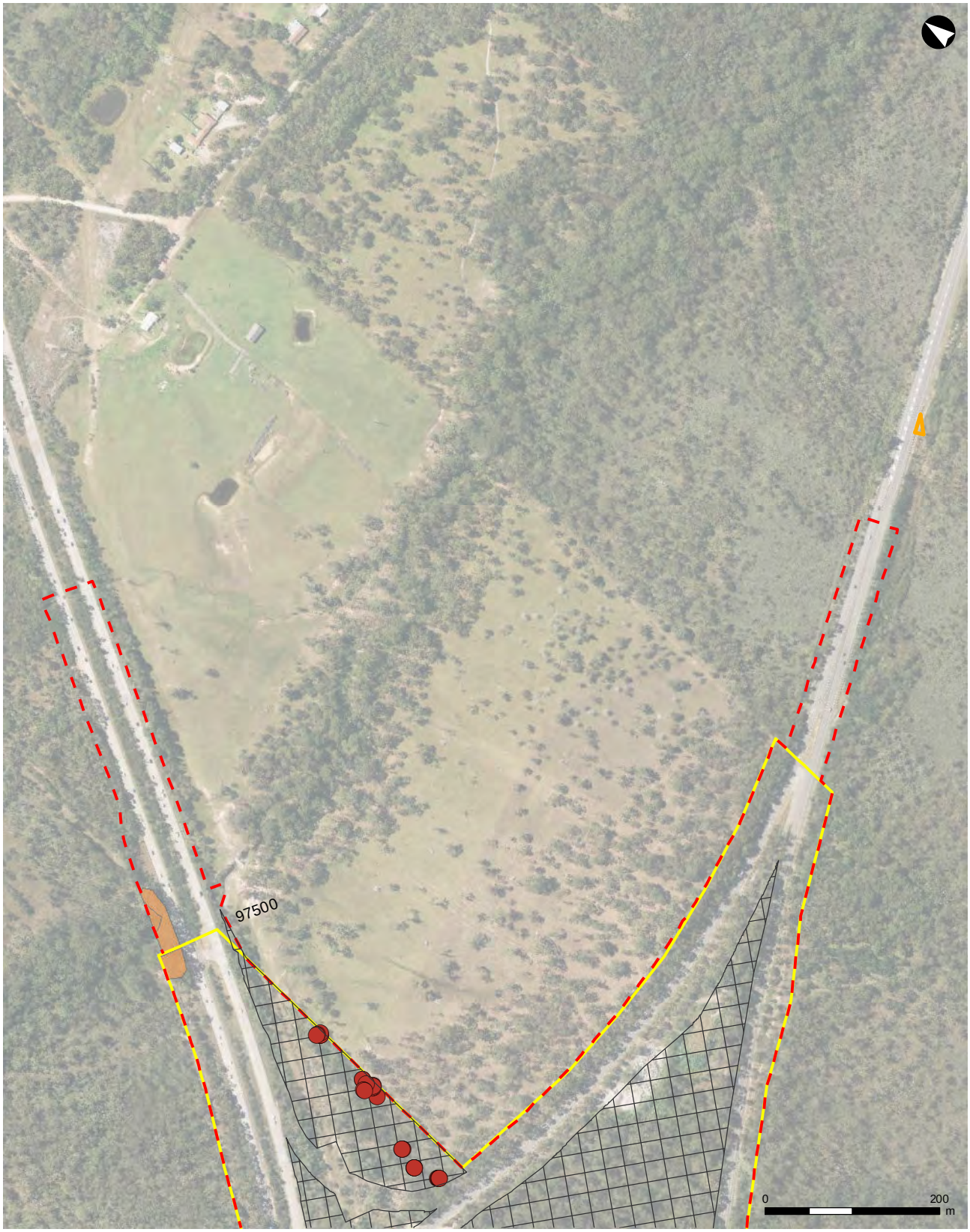


EECs and threatened flora

Tuggerah to Doyalson M1 Upgrade Supplementary REF



LEGEND

- Directional signs construction footprint
- Proposal Boundary
- Original Project Boundary
- Exclusion zone

EEC

- Riverflat Eucalypt Forest

Targeted survey results - M1 Pacific Motorway replacement and widening: Tuggerah to Doyalson Submission Report (SMEC 2014)

- Tetratheca juncea

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EECs and threatened flora

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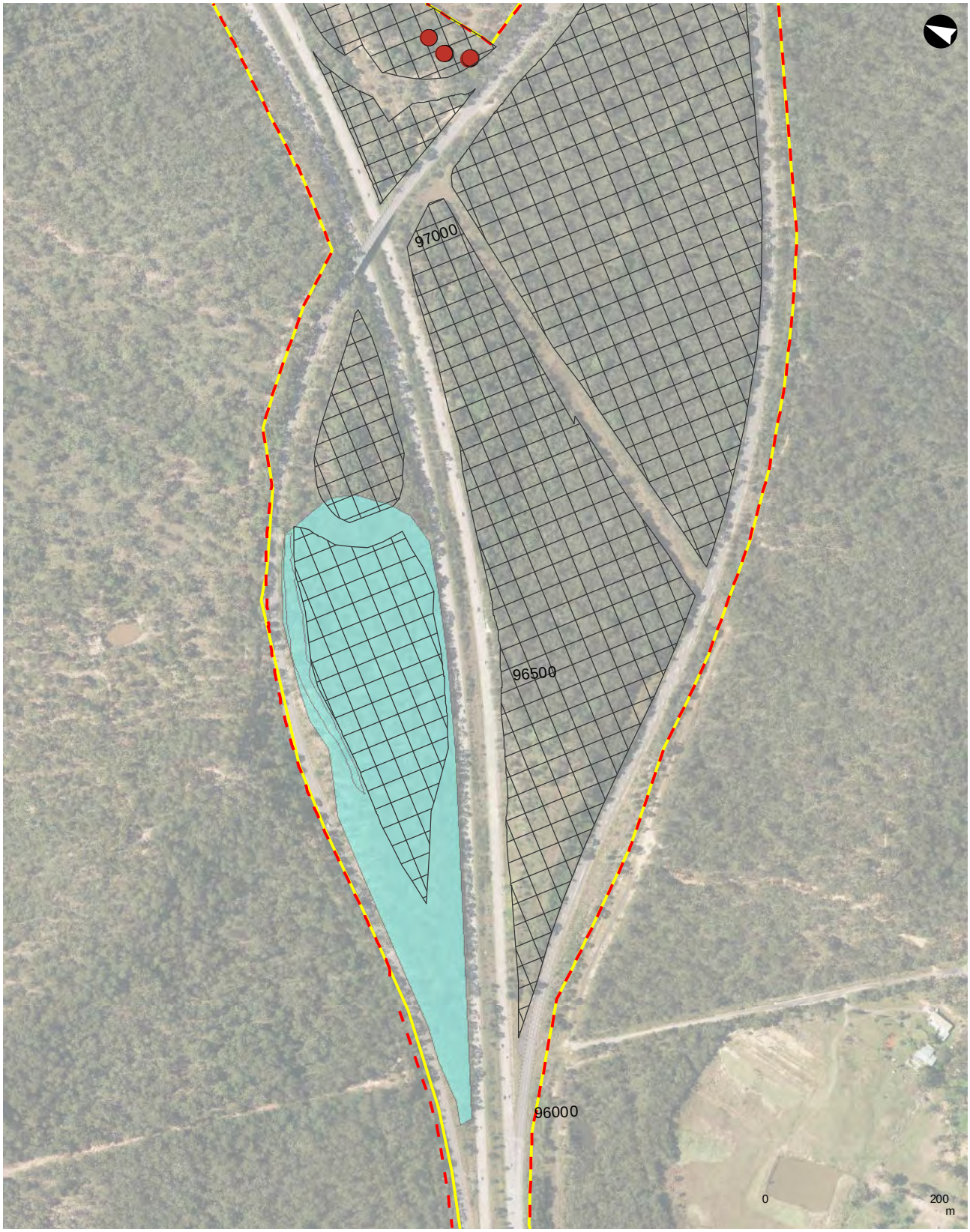
Tuggerah to Doyalson M1 Upgrade Supplementary REF



LEGEND

- Proposal Boundary
- Original Project Boundary
- Exclusion zone

EEC

- Lower Hunter Spotted Gum - Ironbark Forest

Targeted survey results - M1 Pacific Motorway replacement and widening: Tuggerah to Doyalson Submission Report (SMEC 2014)

- Tetratheca juncea

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EECs and threatened flora

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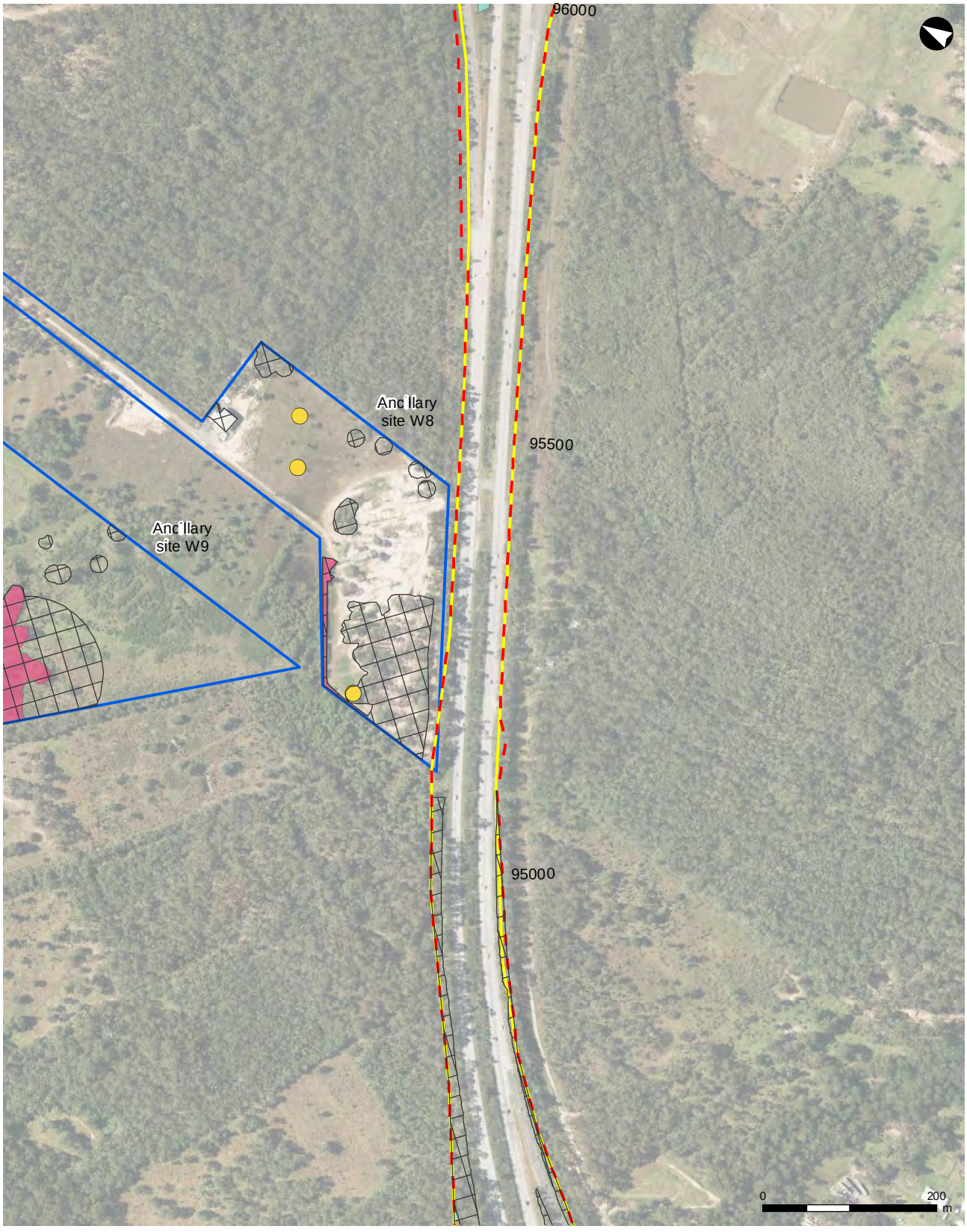
Tuggerah to Doyalson M1 Upgrade Supplementary REF



LEGEND

- Proposal Boundary
- Original Project Boundary
- Proposal ancillary site
- Exclusion zone
- Angophora inopina

EEC

- Lower Hunter Spotted Gum - Ironbark Forest
- Riverflat Eucalypt Forest
- Swamp Sclerophyll Forest on Coastal Floodplains

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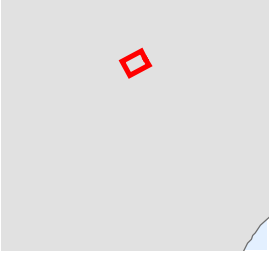

EECs and threatened flora

Date: 21/12/2015 Path: \\HC-AUS-NS-FS-01\jobs\AA007114\L-GIS\A_Current\B_Maps\SupplementaryREF\Ecology\AA007114_SREF_Ecology_FXXX_EECsThreatenedFlora_MB_r1v4.mxd
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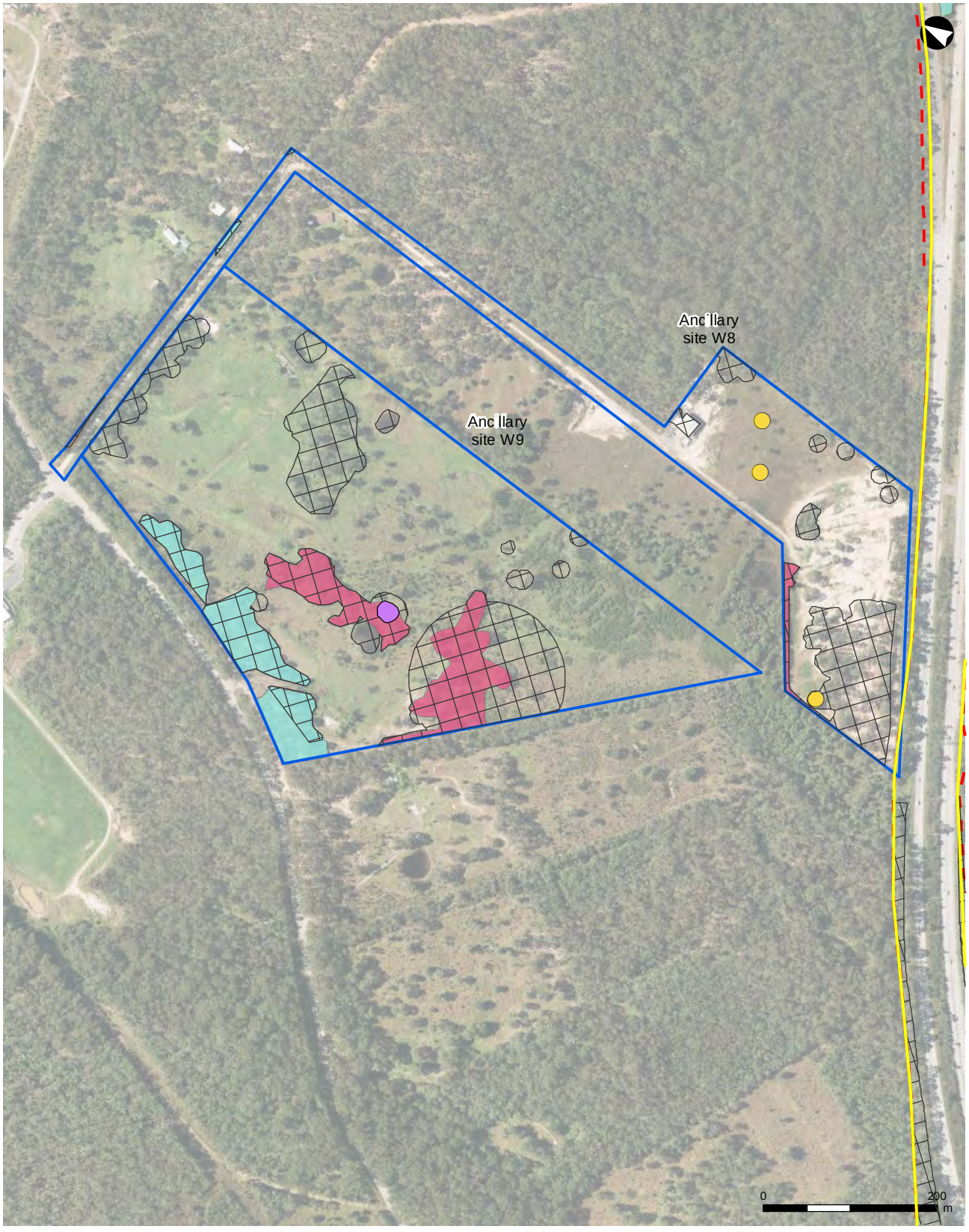
QA by : KC

Tuggerah to Doyalson M1 Upgrade Supplementary REF



LEGEND

- Proposal Boundary
- Original Project Boundary
- Proposal ancillary site
- Exclusion zone
- Angophora inopina
- Melaleuca biconvexa

EEC

- Lower Hunter Spotted Gum - Ironbark Forest
- Riverflat Eucalypt Forest
- Swamp Sclerophyll Forest on Coastal Floodplains

EECs and threatened flora

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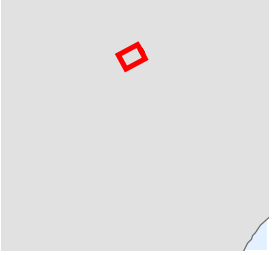

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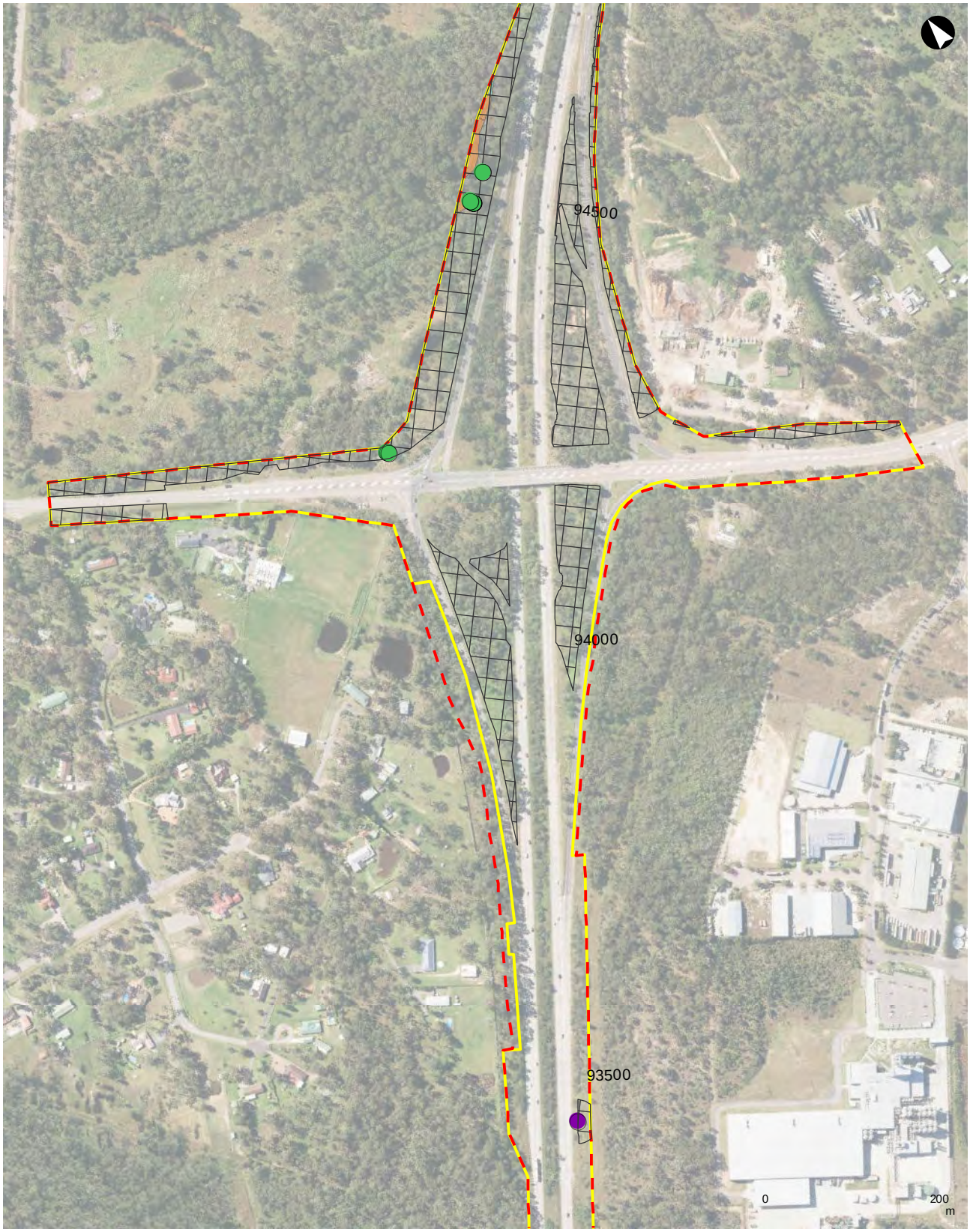
Tuggerah to Doyalson M1 Upgrade Supplementary REF



LEGEND

- Proposal Boundary
- Original Project Boundary
- Exclusion zone

EEC

- Lower Hunter Spotted Gum - Ironbark Forest
- Riverflat Eucalypt Forest

Targeted survey results - M1 Pacific Motorway replacement and widening: Tuggerah to Doyalson Submission Report (SMEC 2014)

- Grevillea parviflora subsp. parviflora
- Potential threatened species

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EECs and threatened flora

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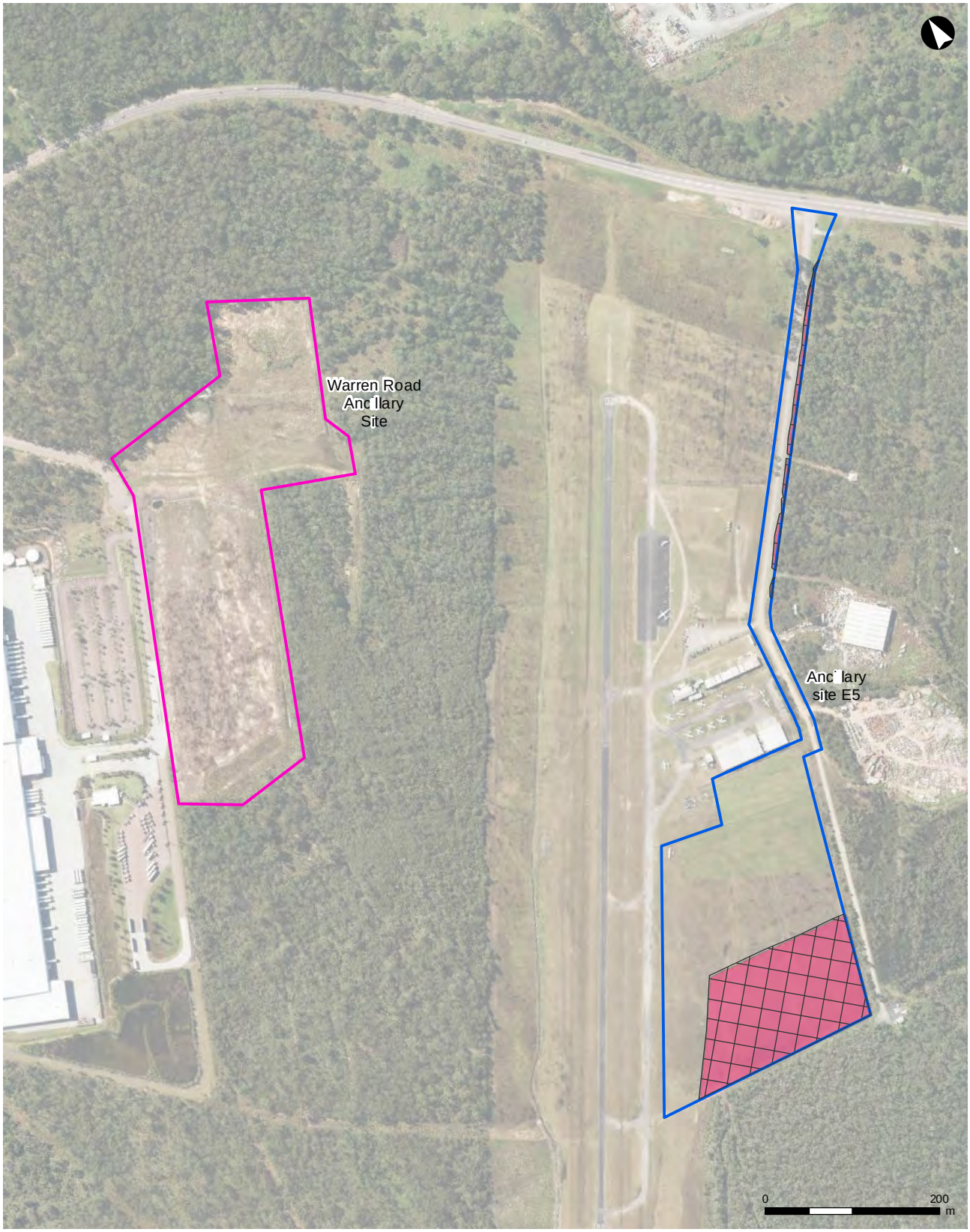
Tuggerah to Doyalson M1 Upgrade Supplementary REF



LEGEND

- Proposal ancillary site
- Project ancillary site
- Exclusion zone

EEC

- Swamp Sclerophyll Forest on Coastal Floodplains

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Tuggerah to Doyalson M1 Upgrade Supplementary REF

LEGEND

- Proposal Boundary
- Original Project Boundary
- Exclusion zone

EEC

- Swamp Sclerophyll Forest on Coastal Floodplains

Targeted survey results - M1 Pacific Motorway replacement and widening: Tuggerah to Doyalson Submission Report (SMEC 2014)

- Potential threatened species

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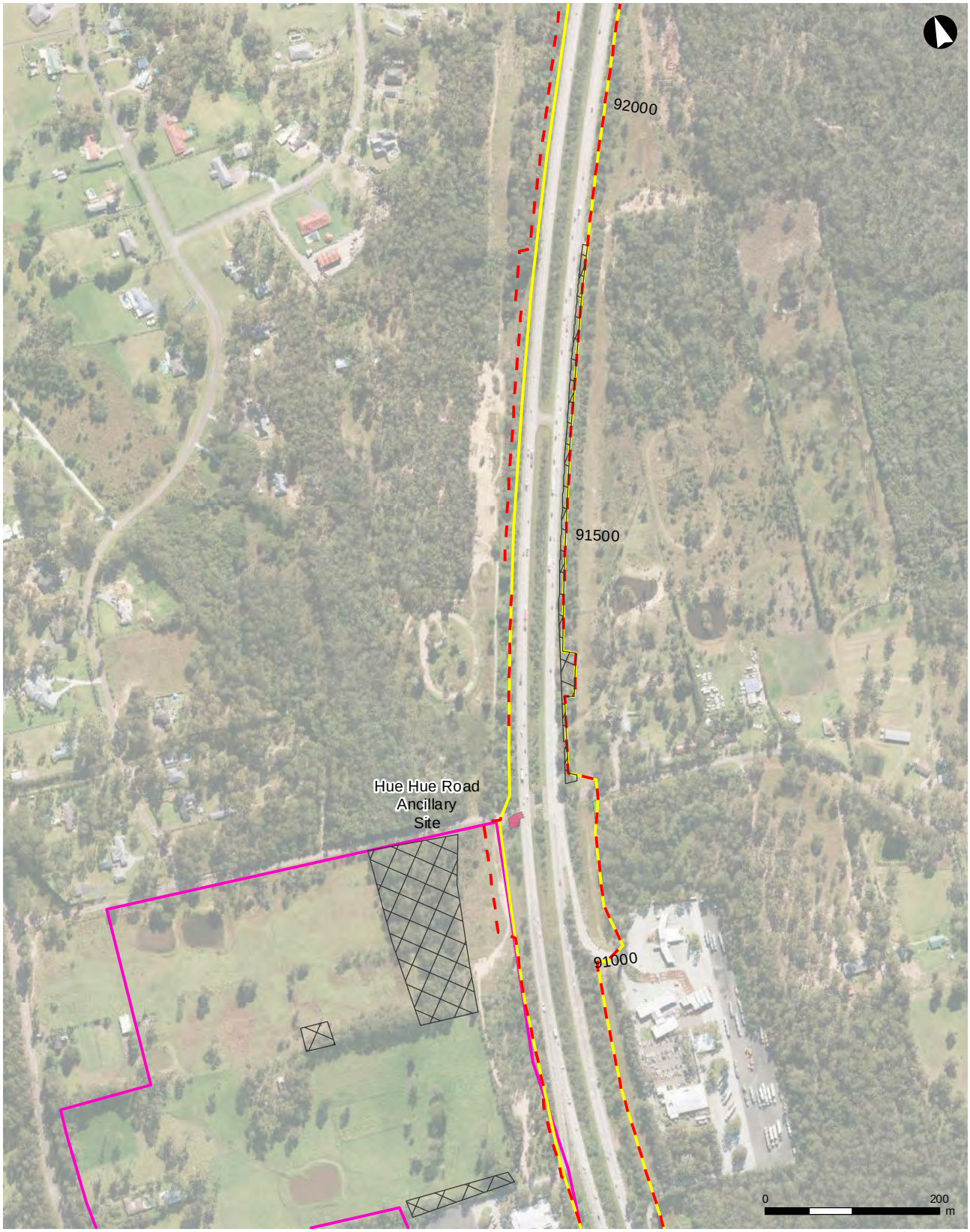

LEGEND

- Proposal Boundary
- Original Project Boundary
- Project ancillary site
- Exclusion zone

EEC

- Disturbed Riverflat Eucalypt Forest OR Swamp Sclerophyll Forest on Coastal Floodplains
- Riverflat Eucalypt Forest OR Swamp Sclerophyll Forest on Coastal Floodplains
- Swamp Sclerophyll Forest on Coastal Floodplains

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EECs and threatened flora

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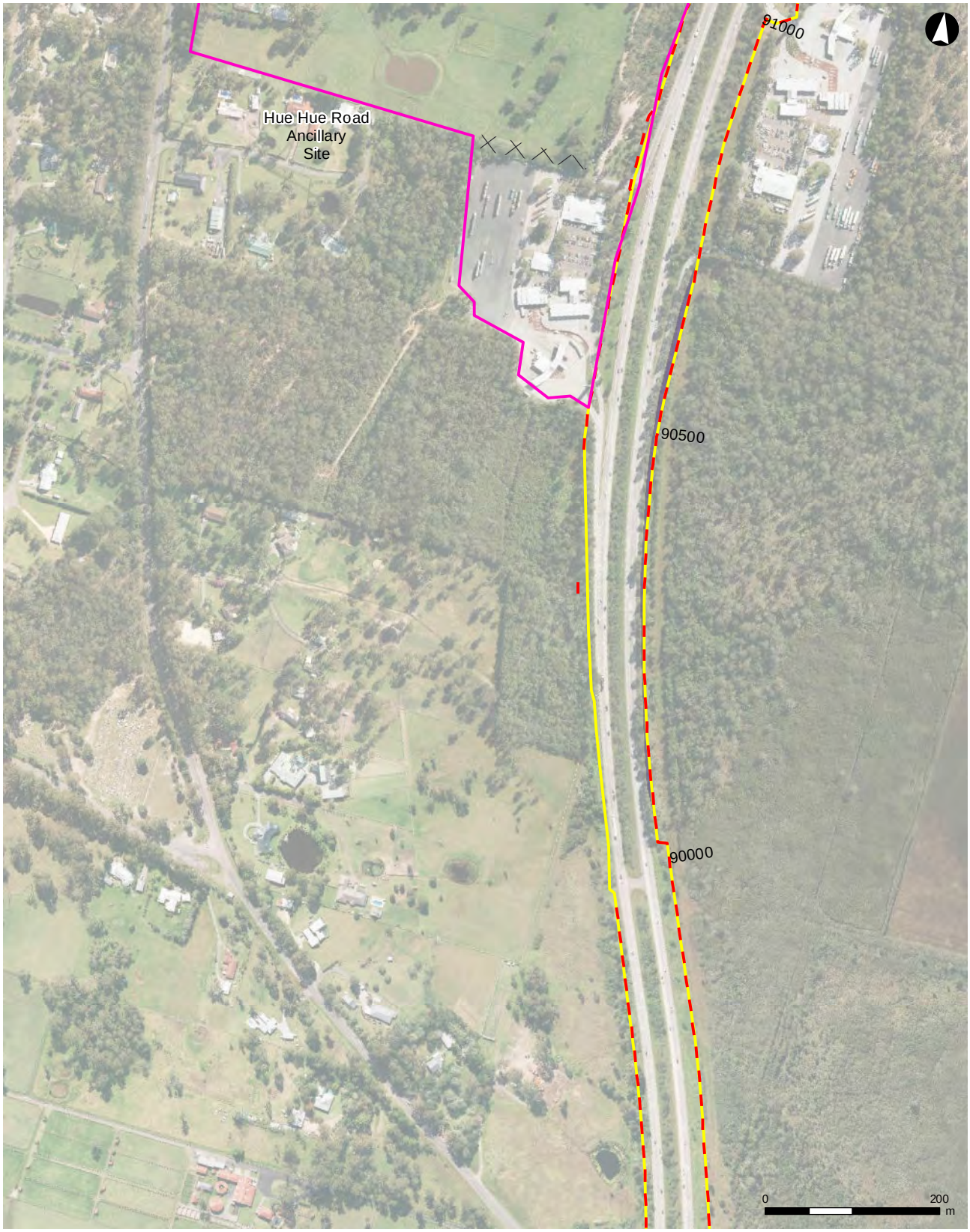

LEGEND

- Proposal Boundary
- Original Project Boundary
- Project ancillary site
- Exclusion zone

EEC

- Riverflat Eucalypt Forest OR Swamp Sclerophyll Forest on Coastal Floodplains
- Swamp Sclerophyll Forest on Coastal Floodplains

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EECs and threatened flora

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Tuggerah to Doyalson M1 Upgrade Supplementary REF

LEGEND

Proposal Boundary

Original Project Boundary

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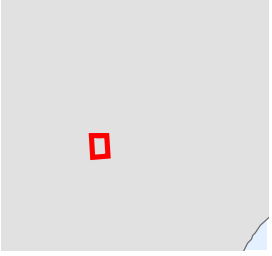

EECs and threatened flora

Tuggerah to Doyalson M1 Upgrade Supplementary REF

LEGEND

Proposal Boundary
Original Project Boundary
Exclusion zone

EEC
Riverflat Eucalypt Forest

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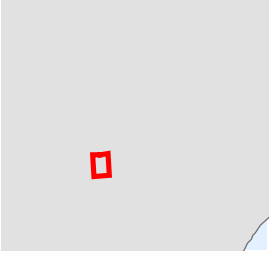

EECs and threatened flora

Tuggerah to Doyalson M1 Upgrade Supplementary REF

LEGEND

- Proposal Boundary
- Original Project Boundary
- Project ancillary site
- Exclusion zone

EEC

- Riverflat Eucalypt Forest
- Swamp Sclerophyll Forest on Coastal Floodplains

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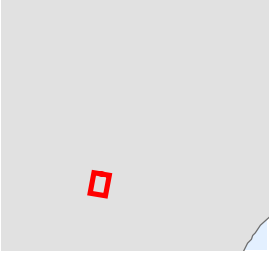
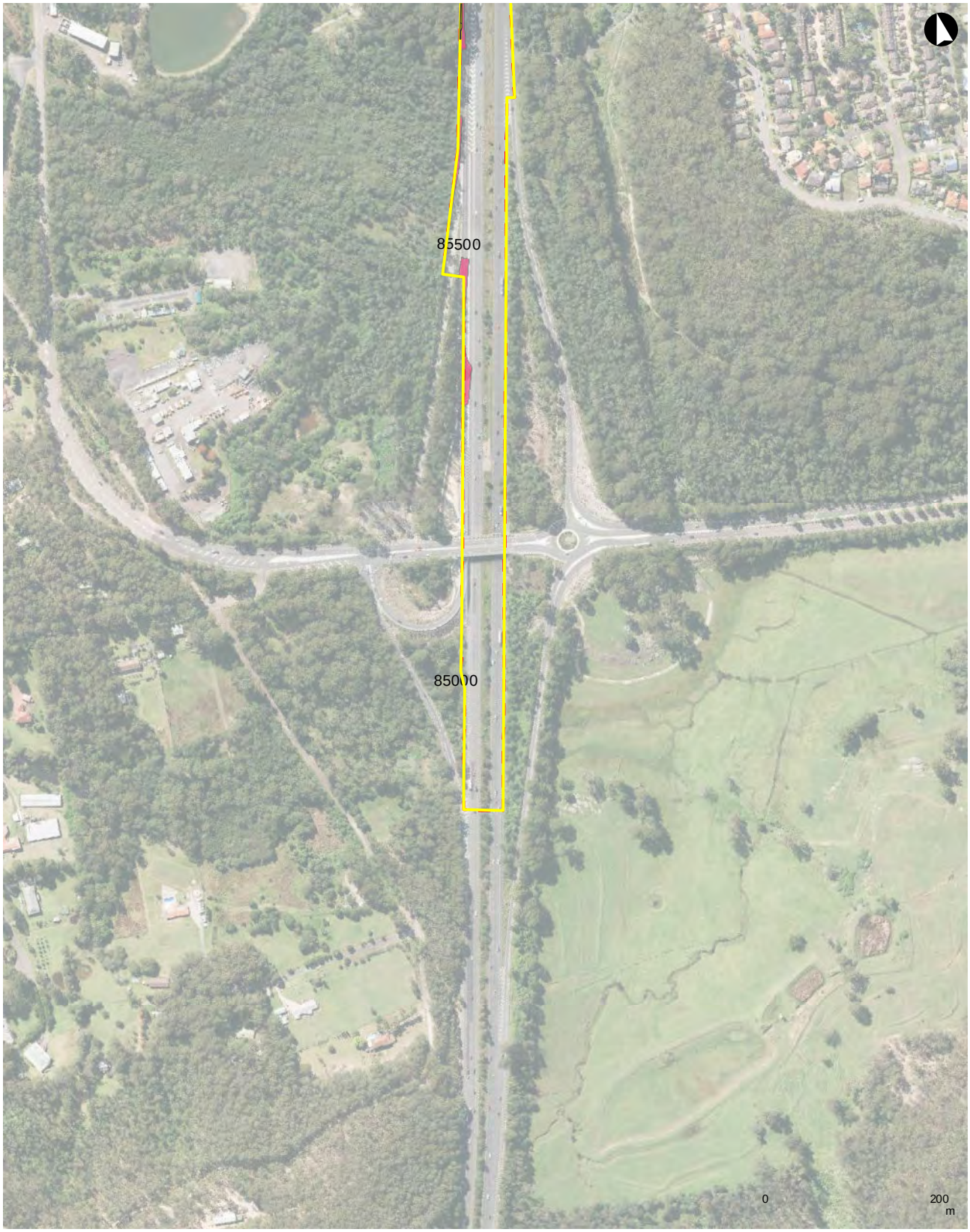


EECs and threatened flora

Tuggerah to Doyalson M1 Upgrade Supplementary REF



LEGEND

- Proposal Boundary
- Original Project Boundary
- Exclusion zone

EEC

- Swamp Sclerophyll Forest on Coastal Floodplains

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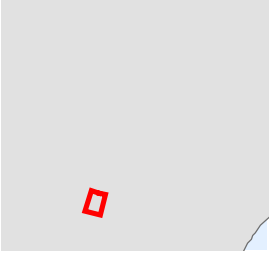

EECs and threatened flora

Figures 3a to 3n - Fauna habitats

Note: Construction exclusion zones shown on this map set may relate to threatened species, fauna habitat features or threatened ecological communities. Figures 1a to 1n, 2a to 2n and 3a to 3n map all of these features.

Tuggerah to Doyalson M1 Upgrade Supplementary REF

LEGEND

Directional signs construction footprint

Fauna habitat

Open Forest

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ABN 76 104 485 289
Level 5, 141 Walker St
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Australia
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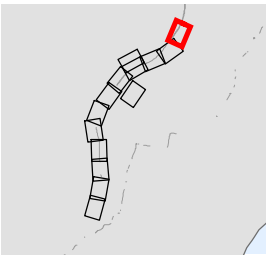

Fauna habitats

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Created by : GC
QA by : KC

Tuggerah to Doyalson M1 Upgrade Supplementary REF

LEGEND

- Directional signs construction footprint
- Proposal Boundary
- Original Project Boundary
- Exclusion zone

Fauna habitat

- Cleared and Disturbed
- Open Forest
- Swamp Forest

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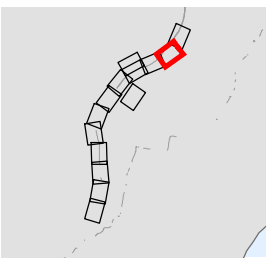

Fauna habitats

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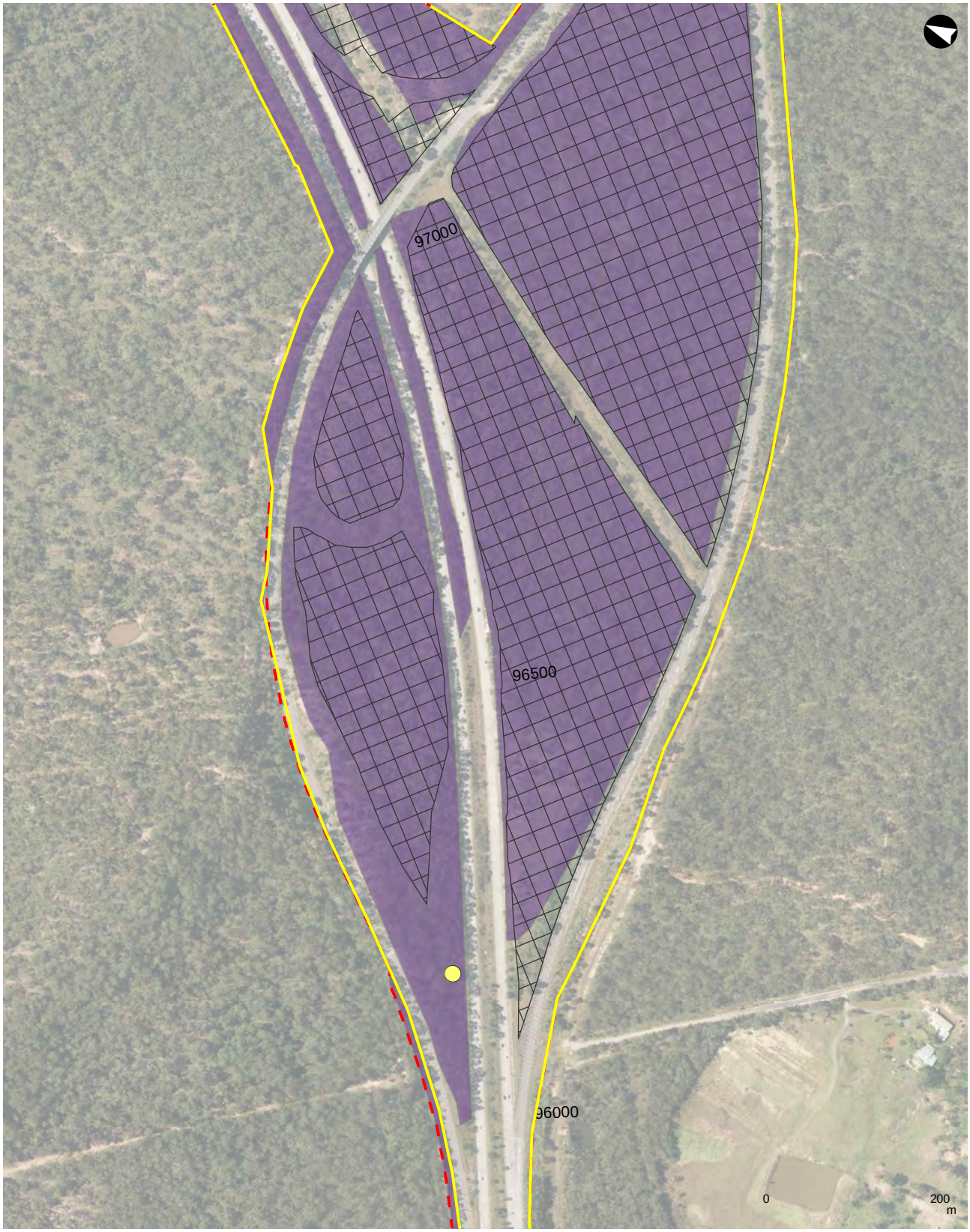
QA by : KC

Tuggerah to Doyalson M1 Upgrade Supplementary REF



LEGEND

- Proposal Boundary
- Original Project Boundary
- Exclusion zone
- Fauna habitat
- Open Forest
- Little Eagle Nest

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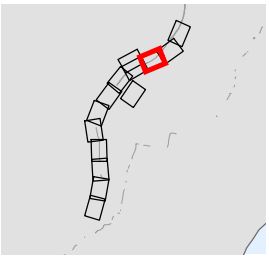

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Created by : GC
QA by : KC

Tuggerah to Doyalson M1 Upgrade Supplementary REF

LEGEND

- Proposal Boundary
- Original Project Boundary
- Proposal ancillary site
- Exclusion zone
- Hollow-bearing tree
- Raptor nest
- Potential Koala habitat

Fauna habitat

- Open Forest
- Swamp Forest

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Australia
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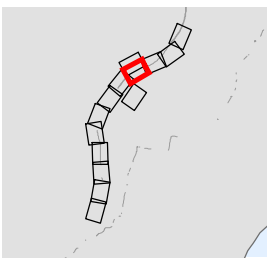

Fauna habitats

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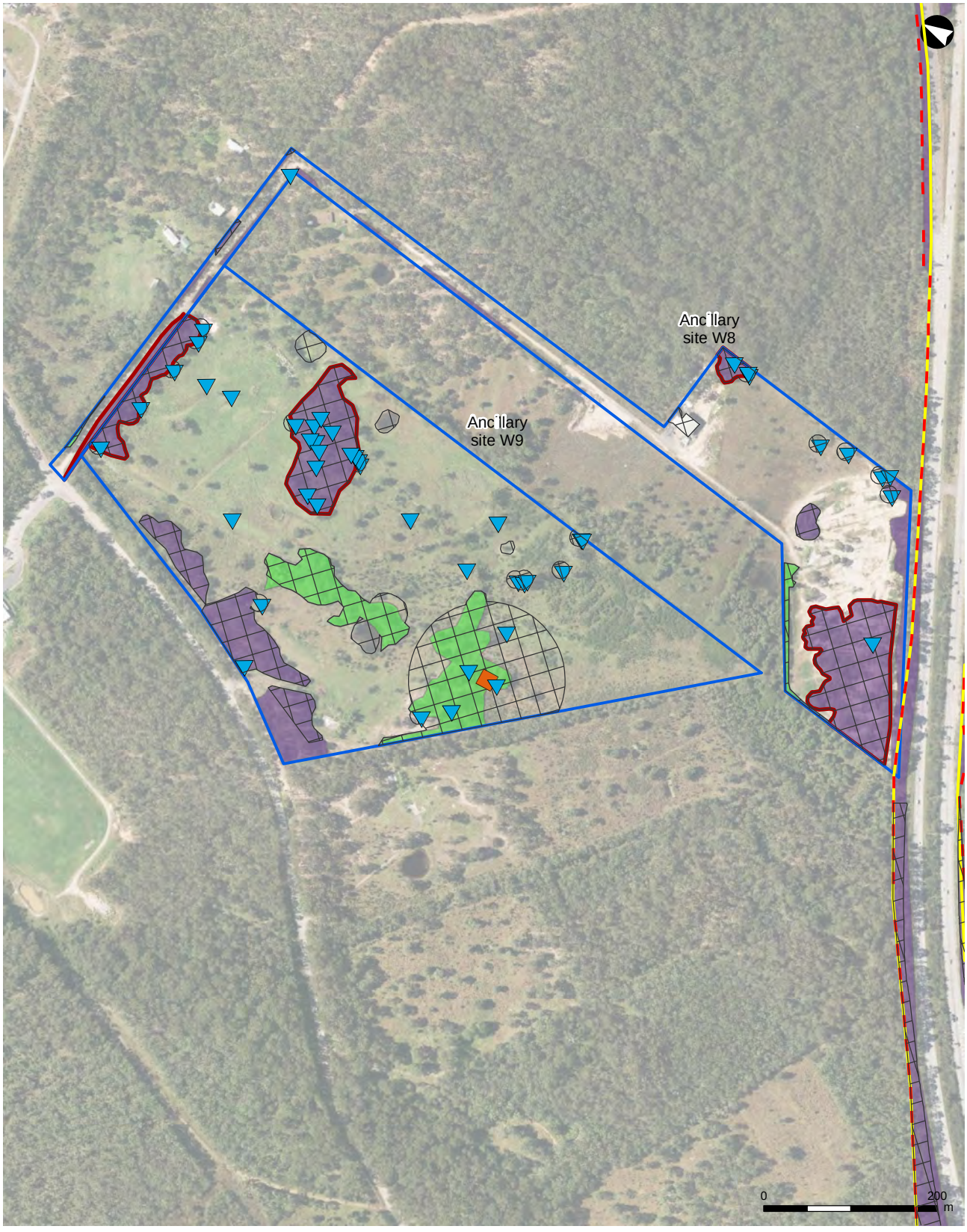
Tuggerah to Doyalson M1 Upgrade Supplementary REF



LEGEND

- Proposal Boundary
- Original Project Boundary
- Proposal ancillary site
- Exclusion zone
- Hollow-bearing tree
- Raptor nest
- Potential Koala habitat

Fauna habitat

- Open Forest
- Swamp Forest

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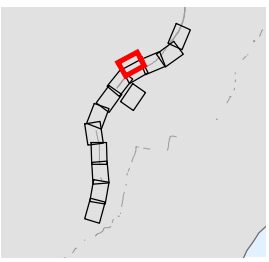

Fauna habitats

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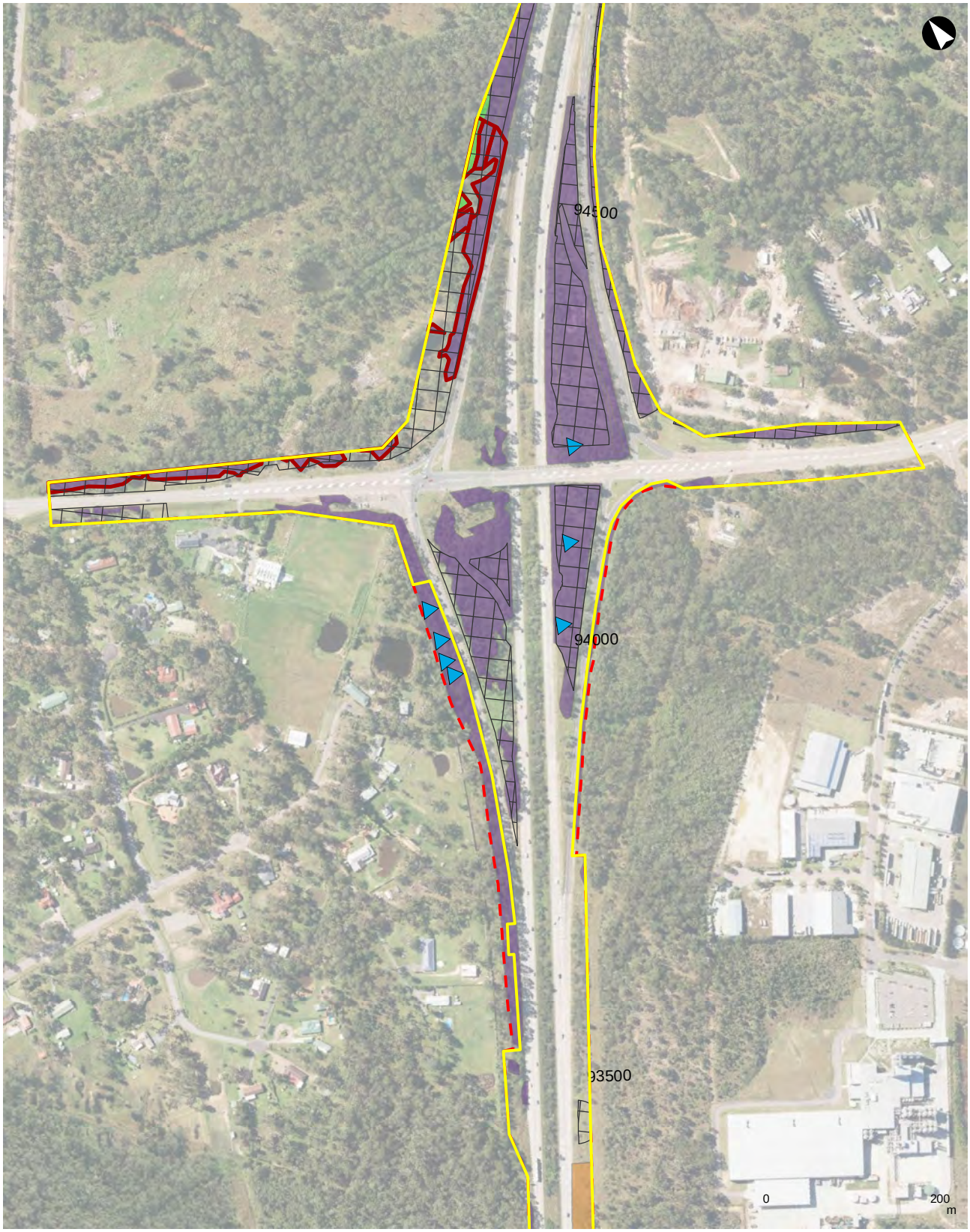
QA by : KC

Tuggerah to Doyalson M1 Upgrade Supplementary REF



LEGEND

- Proposal Boundary
- Original Project Boundary
- Exclusion zone
- Hollow-bearing tree
- Potential Koala habitat

Fauna habitat

- Cleared and Disturbed
- Open Forest
- Swamp Forest

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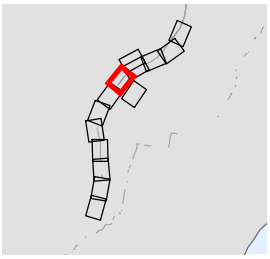

Fauna habitats

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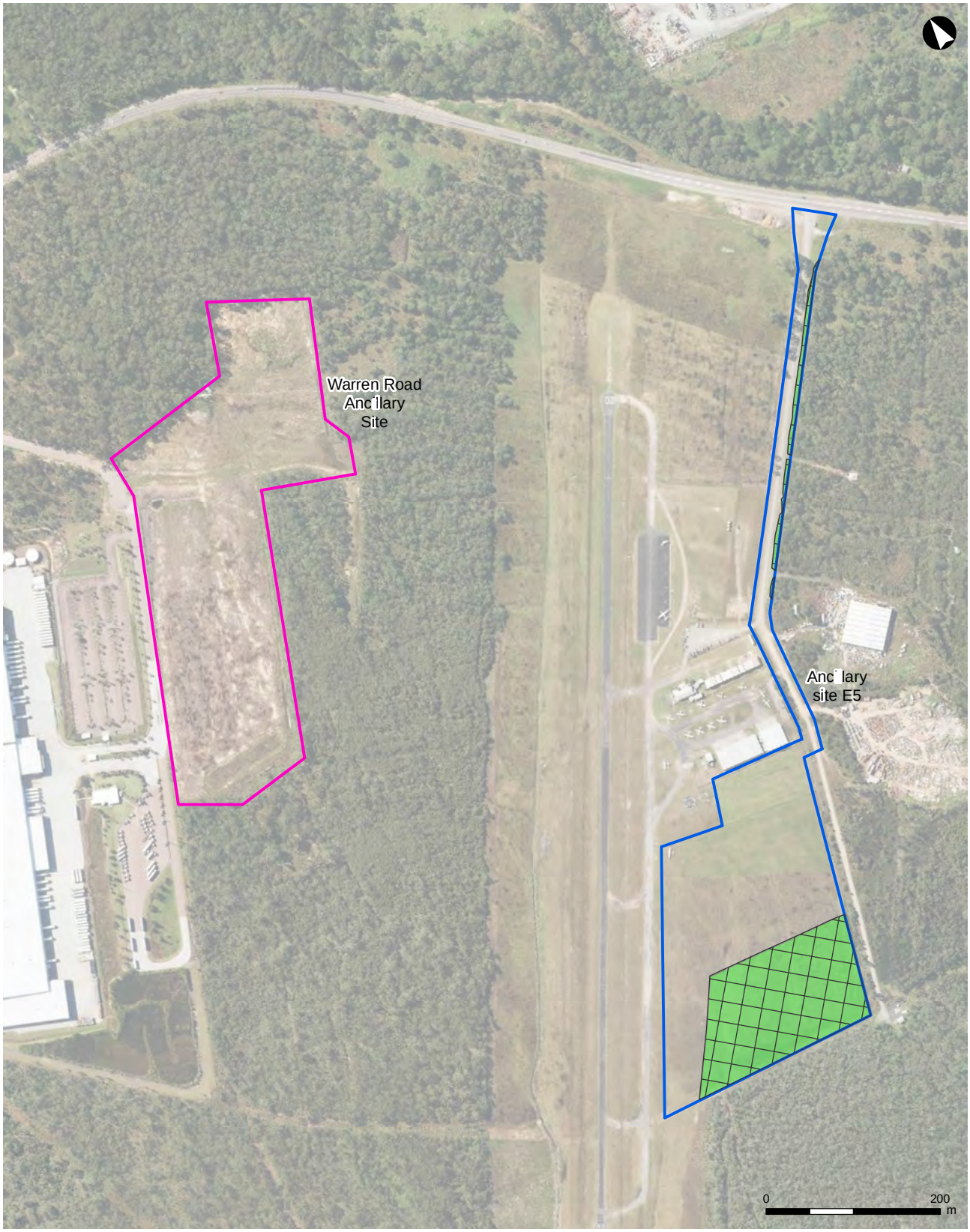
QA by : KC

Tuggerah to Doyalson M1 Upgrade Supplementary REF



LEGEND

- Proposal ancillary site
- Project ancillary site
- Exclusion zone
- Fauna habitat
- Swamp Forest

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Australia
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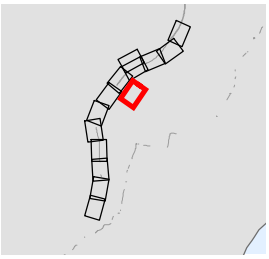

Fauna habitats

Tuggerah to Doyalson M1 Upgrade Supplementary REF

LEGEND

- Proposal Boundary
- Original Project Boundary
- Exclusion zone

Fauna habitat

- Cleared and Disturbed
- Open Forest
- Swamp Forest

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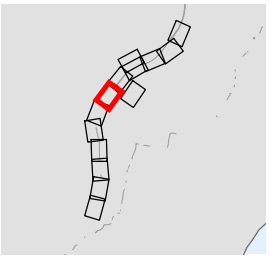

Fauna habitats

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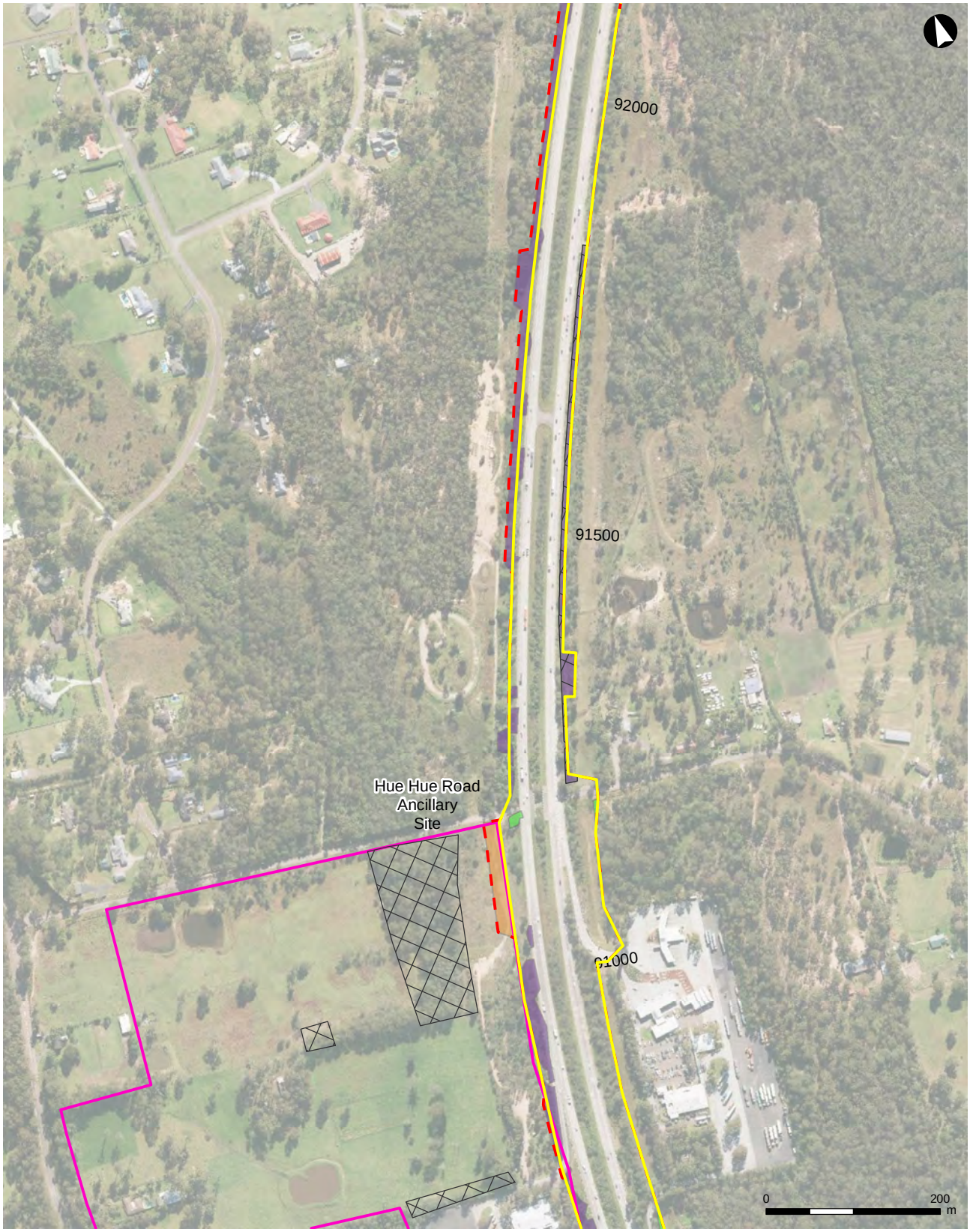
QA by : KC

Tuggerah to Doyalson M1 Upgrade Supplementary REF



LEGEND

- Proposal Boundary
- Original Project Boundary
- Project ancillary site
- Exclusion zone

Fauna habitat

- Cleared and Disturbed
- Open Forest
- Swamp Forest

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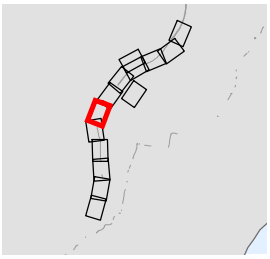

Fauna habitats

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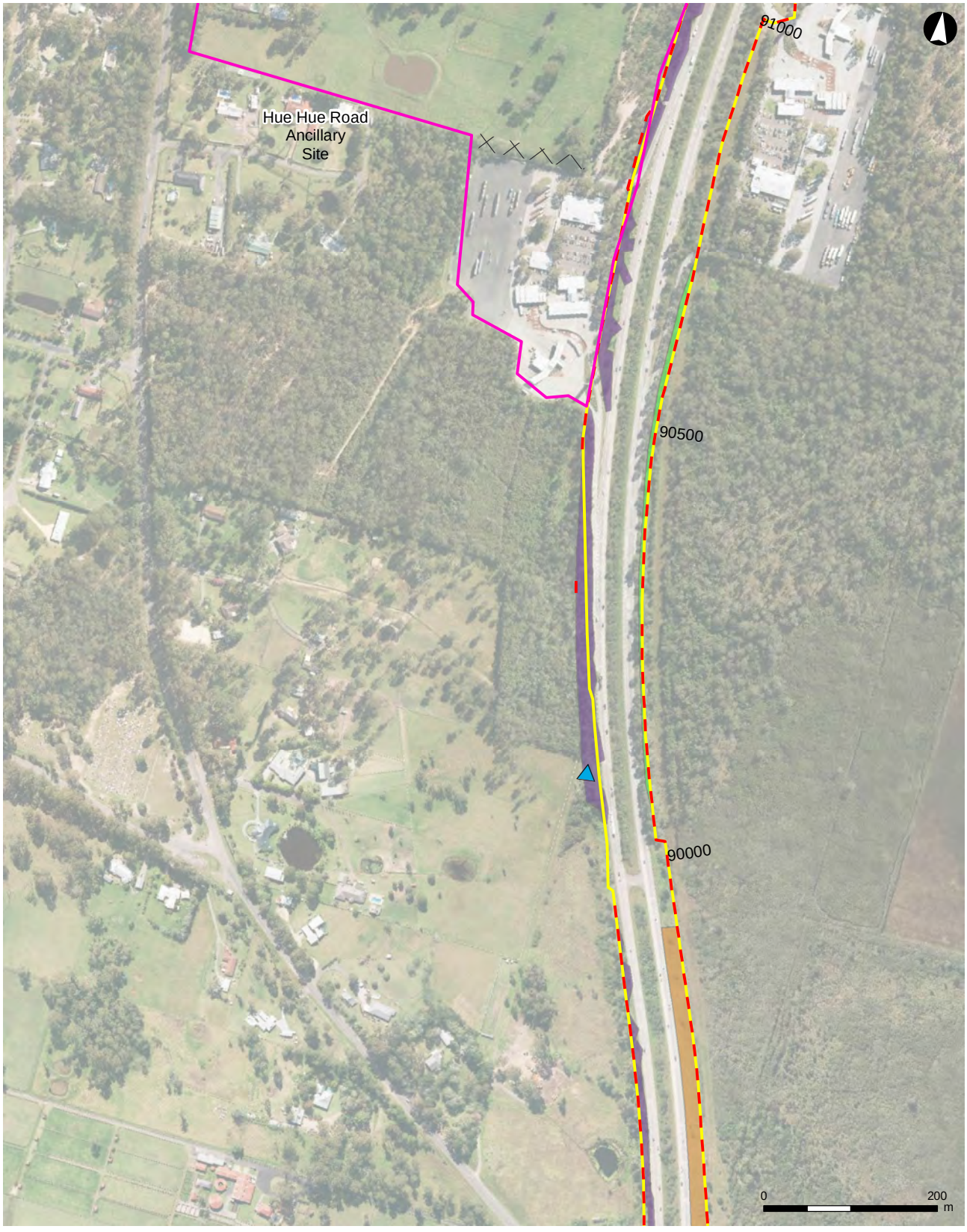
Tuggerah to Doyalson M1 Upgrade Supplementary REF



LEGEND

- Proposal Boundary
- Original Project Boundary
- Project ancillary site
- Exclusion zone
- Hollow-bearing tree

Fauna habitat

- Cleared and Disturbed
- Open Forest
- Swamp Forest

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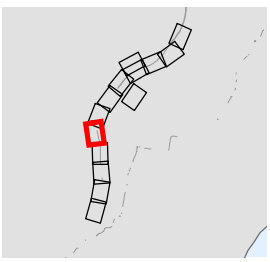

Fauna habitats

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Tuggerah to Doyalson M1 Upgrade Supplementary REF

LEGEND

Proposal Boundary
Original Project Boundary

Fauna habitat
Cleared and Disturbed
Open Forest

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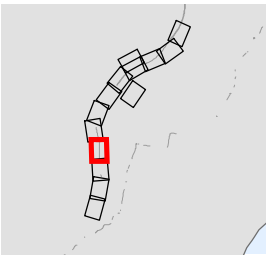

Fauna habitats

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Created by : GC
QA by : KC

Tuggerah to Doyalson M1 Upgrade Supplementary REF

LEGEND

- Proposal Boundary
- Original Project Boundary
- Exclusion zone

Fauna habitat

- Open Forest
- Swamp Forest

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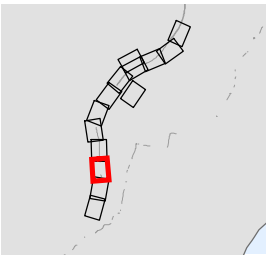

Fauna habitats

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Created by : GC
QA by : KC

Tuggerah to Doyalson M1 Upgrade Supplementary REF

LEGEND

- Proposal Boundary
- Original Project Boundary
- Project ancillary site
- Exclusion zone

Fauna habitat

- Open Forest
- Swamp Forest

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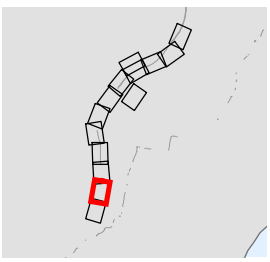

Fauna habitats

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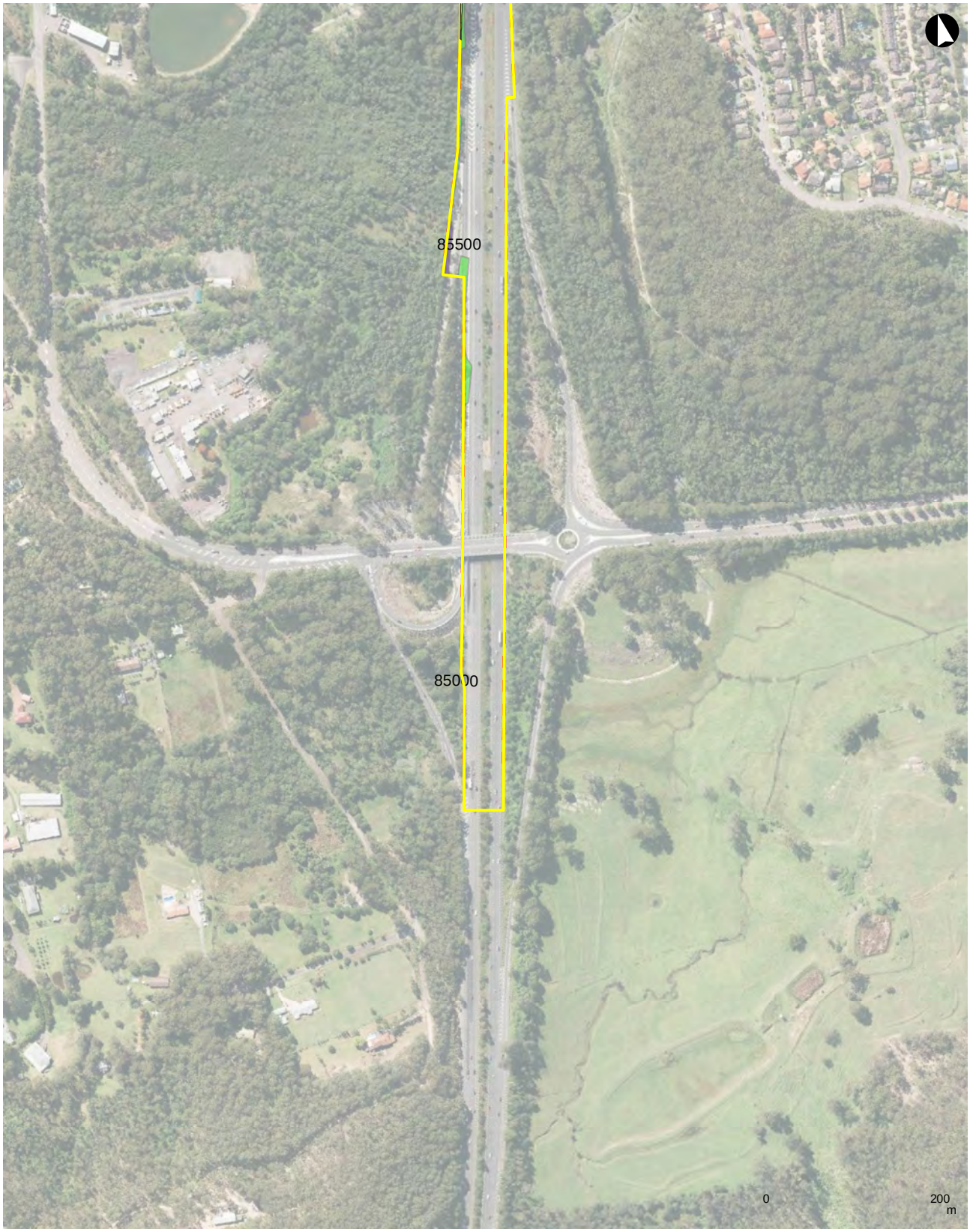
Tuggerah to Doyalson M1 Upgrade Supplementary REF



LEGEND

Proposal Boundary
Original Project Boundary
Exclusion zone

Fauna habitat
Open Forest
Swamp Forest

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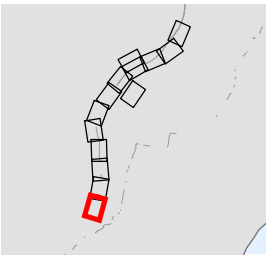

Fauna habitats

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QA by : KC

Appendix B

Threatened Species Likelihood of Occurrence Assessment

Assessment of the likelihood of occurrence of threatened flora species in the Proposal Boundary as identified in updated database searches

Species Name	TSC Act	EPBC Act	Habitat Requirements	Likelihood of occurrence
Callistemon linearifolius Netted Bottle Brush	V		Grows in dry sclerophyll forest on the coast and adjacent ranges, chiefly from Georges River to the Hawkesbury River. Vegetation type is open-forest e.g. with *Corymbia eximia, Eucalyptus punctata, E. umbra, Allocasuarina littoralis, Angophora costata* (Benson and McDougall 1998).	Low. There are three records of the species located approximately 6 km east of the site. Although habitat for this species is not well defined, none of the vegetation types listed in the Threatened Species Profile for *Callistemon linearifolius* are present within the Proposal Boundary.
Corunastylis sp. Charmhaven (NSW896673)	CE	CE	*Corunastylis* sp. Charmhaven (NSW896673) is currently only known from the Wyong Shire of NSW where it is restricted to a single location in the Gorokan/Charmhaven area. It occurs within low woodland to heathland with a shrubby understorey and ground layer. Dominants include Black She-oak (*Allocasuarina littoralis*), Prickly Tea-tree (*Leptospermum juniperinum*), Prickly-leaved Paperbark (*Melaleuca nodosa*), Narrow-leaved Bottlebrush (*Callistemon linearis*) and Zig-zag Bog-rush (*Schoenus brevifolius*).	Low. The species is restricted to one location approximately 4 km north-east of the Proposal Boundary. No potential habitat is present within the Proposal Boundary.
Diuris bracteata	E	Ex	For over 100 years *Diuris bracteata* was known only from the original collection made near Gladesville in northern Sydney. In recent years, however, extant populations from north-west of Gosford have been recorded and this area is now the only known area of occurrence of the species. All known plants fall within the Gosford and Wyong Local Government Areas. Occurs in dry sclerophyll woodland and forest with a predominantly grassy understorey.	Low. There is one record of the species located approximately 9.9 km south-west of the Proposal Boundary. Although habitat for this species is not well defined, none of the vegetation types listed in the Threatened Species Profile for *Diuris bracteata* are present within the Proposal Boundary.
Epacris purpurascens var. purpurascens	V		Grows in sclerophyll forest, scrubs and swamps on sandstone from Gosford and Sydney districts. Found	Low. There is one record of the species located

Species Name	TSC Act	EPBC Act	Habitat Requirements	Likelihood of occurrence
			in a range of habitat types, most of which have a strong shale soil influence.	approximately 5 km south of the Proposal Boundary. Potential habitat for the species does not occur within the Proposal Boundary.
Eucalyptus oblonga population at Bateau Bay, Forresters Beach and Tumbi Umbi in the Wyong LGA	EP		The species occurs from Gosford to the Appin and Waterfall districts. The disjunct outlier population at Bateau Bay, Forresters Beach and Tumbi Umbi includes occurrences on the Patonga Claystone Formation and derived soils, corresponding to the Woodburys Bridge Soil Landscape. Here it is at the eastern limit of the species' range and is of significant conservation value because elsewhere the species occurs on sandstone. The population of *Eucalyptus oblonga* consists of about 20 trees. The species is normally found in dry open forest with infertile sandy soils on sandstone. The population at Bateau Bay occurs on coastal sands.	Low. The outlier population is located approximately 7 km south-east of the Proposal Boundary. Potential habitat for the species does not occur on the site.
Genoplesium baueri Yellow Gnat Orchid	E	E	The species has been recorded from locations between Ulladulla and Port Stephens. The species has been recorded at locations now likely to be within the following conservation reserves: Berowra Valley Regional Park, Royal National Park and Lane Cove National Park. May occur in the Woronora, O'Hares, Metropolitan and Warragamba Catchments. It grows in dry sclerophyll forest and moss gardens over sandstone and flowers February to March.	Low. No records of this species within 10km of the site or north of the Hawkesbury River (EPBC predicted occurrence only). Potential habitat for the species does not occur on the site.
Genoplesium insigne Variable Midge Orchid	E	CE	Recorded from four localities between Chain Valley Bay and Wyong in Wyong local government area. Grows in patches of *Themeda triandra* (Kangaroo Grass) amongst shrubs and sedges in heathland and forest.	Low. There are several records of the species in one location approximately 4 km north-east of the site.

Species Name	TSC Act	EPBC Act	Habitat Requirements	Likelihood of occurrence
				There may be marginal potential habitat for the species in communities near the site, but the vegetation within the site is likely to be too disturbed.
Hibbertia procumbens Spreading Guinea Flower	E		Majority of known populations occur within *Banksia ericifolia–Angophora hispida–Allocasuarina distyla* scrub/heath on skeletal sandy soils. May also be found associated with 'hanging swamp' vegetation communities on sandy deposits. Flowers in summer.	Low. There is one record of the species over 9 km to the south-west of the Proposal Boundary. No potential habitat is present on the site.
Persicaria elatior Tall Knotweed	V	V	Normally grows in damp places, especially beside streams and lakes. Occasionally in swamp forest or associated with disturbance.	Low. There is one record of the species approximately 9.5 km to the north of the Proposal Boundary. No potential habitat is present on the site.
Senna acclinis Rainforest Cassia	E		Occurs in coastal districts and adjacent tablelands of NSW from the Illawarra in NSW to Queensland. Grows on the margins of subtropical, littoral and dry rainforests. Often found as a gap phase shrub.	Low. There is one record approximately 5.5 km south-west of the Proposal Boundary. No potential habitat is present on the site.
Thesium australe Austral Toadflax	V	V	Austral Toadflax is found in very small populations scattered across eastern NSW, along the coast, and from the Northern to Southern Tablelands. Although originally described from material collected in the SW Sydney area, populations have not been seen in a long time. It may persist in some areas in the broader region. The species occurs in grassland on coastal headlands or grassland and grassy woodland away from the coast. It is often found in association with Kangaroo Grass (*Themeda triandra*).	Low. No records of this species within 10km of the search (EPBC predicted occurrence only). The closest recent record is located over 100 km west of the site.

Assessment of the likelihood of occurrence of threatened and migratory fauna species in the Proposal Boundary as identified in updated database searches. Species restricted to marine environments and offshore islands have been excluded from this assessment due to absence of habitat.

Name	TSC Act	EPBC Act	Habitat Requirements	Likelihood of occurrence
Barking Owl *Ninox connivens*	V		Scattered distribution throughout Australia, excluding central arid areas. In NSW, core populations are 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 midstorey trees. Requires large, hollow-bearing eucalypts for nesting habitat.	High. Two recent records approximately 6 km to south-east of Proposal Boundary. Potential foraging habitat is present.
Black falcon *Falco subniger*	V		The Black Falcon inhabits woodland, shrubland and grassland in the arid and semi-arid zones, especially wooded watercourses and agricultural land with scattered remnant trees. The Black Falcon is usually associated with streams or wetlands, visiting them in search of prey and often using standing dead trees as lookout posts. Habitat selection is generally influenced more by prey densities than by specific aspects of habitat floristics or condition, although in agricultural landscapes the Black Falcon tends to nest in healthy, riparian woodland remnants with a diverse avifauna	Low. Species typically found in arid and semi-arid zones.
Broad-billed Sandpiper *Limicola falcinellus*	V	M	The Broad Billed Sandpiper breeds in northern Siberia before migrating southwards in winter to Australia. During winter, the species inhabits sheltered parts of the coast such as estuarine sandflats and mudflats, harbours, embayments, lagoons, saltmarshes and reefs as feeding and roosting habitat.	Low. Suitable habitat not present.
Brown Treecreeper (eastern subpecies) *Climacterus victoriae picmunus*	V		Occurs in eucalypt forests and woodlands of inland plains and slopes of the Great Dividing Range. Western boundary of its distribution is through Wagga Wagga, Forbes, Dubbo and Inverell. It is less commonly found on coastal plains and ranges. Forage mainly for invertebrates in fallen timber, trees	High. Two records are present from 2014 approximately 7km northwest of the

Name	TSC Act	EPBC Act	Habitat Requirements	Likelihood of occurrence
			and shrubs. Require hollows in standing dead or live trees and tree stumps for nesting.	Proposal Boundary. Potential habitat is present in open forest. .
Bush Stone-curlew *Burhinus grallarius*	E		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.	High. 14 records within 10 km of the Proposal Boundary; the closest record is 1.5 km to the south-east. Potential habitat is present in open forest.
Cattle Egret *Ardea ibis*		M	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.	High. Potential habitat is present in open forest, swamp forest, and cleared grasslands.
Comb-crested Jacana *Irediparra gallinacea*	V		Occurs on freshwater wetlands in northern and eastern Australia, mainly in coastal and subcoastal regions, from the north-eastern Kimberley Division of Western Australia to Cape York Peninsula then south along the east coast to the Hunter region of NSW. Comb-crested Jacana inhabit permanent freshwater wetlands, either still or slow-flowing, with a good surface cover of floating vegetation, especially water-lilies, or fringing and aquatic vegetation.	Low. Suitable habitat not present.
Eastern Bristlebird *Dasyornis brachypterus*	E	E	Distribution confined to three disjunct areas in NSW: the Queensland/NSW border, the Illawarra and the NSW/Victoria border. Species inhabits dense, low vegetation including heath and open woodland with a heathy understorey.	Low. No records of this species within 10km of the search (EPBC predicted occurrence only).
Eastern cave Bat	V		Distributed along eastern of Australia, from Cape York south	Low.

Name	TSC Act	EPBC Act	Habitat Requirements	Likelihood of occurrence
Vespadelus troughtoni			to mid-New South Wales. A cave-roosting species that is usually found in dry open forest and woodland, near cliffs or rocky overhangs. It has been recorded roosting in disused mine workings, occasionally in colonies of up to 500 individuals. Occasionally found along cliff-lines in wet eucalypt forest and rainforest. Little is understood of its feeding or breeding requirements or behaviour.	Suitable habitat not present.
Eastern Chestnut Mouse *Pseudomys gracilicaudatus*	V		Scattered distribution from Queensland to the Hawkesbury River in NSW, also found in the Jervis Bay area. Found in dense, wet heath and swamps; heath regenerating from fire is most preferred. Forages amongst grasses and sedges for grass stems, invertebrates, fungi and seeds.	High. Two records from 2012 located 1.2 and 2.6 km from the northern end of the Proposal Boundary. Potential habitat is present in swamp forest.
Eastern Osprey *Pandion cristatus*	V	M	Found around the Australian coast line. They are common around the northern coast, especially on rocky shorelines, islands and reefs. The species is uncommon to rare or absent from closely settled parts of south-eastern Australia. They forage for fish over clear, open water. Nests are made high up in dead trees or in dead crowns of live trees, usually within one km of the sea.	High. Record from 2008 in Proposal Boundary near Sparks Road. Potential foraging habitat is present.
Eastern Pygmy-possum *Cercartetus nanus*	V		Occurs from the coast inland to the Pillaga, Dubbo, Parkes and Wagga Wagga on the western slopes. Inhabits woodlands and heath, occasionally rainforest where it forages for nectar and pollen of banksias, eucalypts and bottlebrushes. Shelters in tree hollows, rotten stumps, holes in the ground or abandoned bird-nests.	High. Three records within 10 km of the Proposal boundary, of which two dated from 2012 are within 3 km. Potential habitat is present in open forest.
Flame robin	V		In NSW, the species breeds in tall moist eucalypt forests and	Low. Habitat marginal.

Name	TSC Act	EPBC Act	Habitat Requirements	Likelihood of occurrence
Petroica phoenicea			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.	One record of the species is present within 10km of the Proposal Boundary from 1998.
Gang-gang Cockatoo *Callocephalon fimbriatum*	V		Found in the central NSW coast and Tableland areas, including Canberra and the Hawkesbury/Nepean and Sydney Metro region. However the Hornsby and Kuringai 'population' which is the last known breeding population in the Sydney metro region is endangered (estimated 18 - 40 pairs). 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.	High. 20 records within 10 km of the Proposal Boundary, one of which is located within the proposal Boundary near Sparks Road. Potential habitat is present in open forest.
Giant Dragonfly *Petalura gigantea*	E		The Giant Dragonfly is found along the east coast of NSW from the Victorian border to northern NSW. Known occurrences in the Blue Mountains. Live in permanent swamps and bogs with some free water and open vegetation.	Low. Suitable habitat not present.
Golden-tipped Bat *Kerivoula papuensis*	V		The Golden-tipped Bat is distributed along the east coast of Australia in scattered locations from Cape York Peninsula in Queensland to south of Eden in southern NSW. Found in rainforest and adjacent wet and dry sclerophyll forest up to 1000m. Also recorded in tall open forest, Casuarina-dominated riparian forest and coastal Melaleuca forests. Roost mainly in abandoned hanging Yellow-throated Scrubwren and Brown Gerygone nests, also in tree hollows, dense foliage and epiphytes; located in rainforest gullies on small first- and second-order streams. Will fly up to two kms from roosts to forage in rainforest and sclerophyll forest on mid and upper-slopes. Specialist feeder on small web-building spiders.	High. 25 records within 10 km of the Proposal Boundary, the closest of which is 1.2 km. Potential foraging habitat is present in open forest.
Great Egret *Ardea alba*		M	Occurs throughout Australia excluding arid areas. Inhabit lakes, swamps, dams and rivers and occasionally damp	High. Potential habitat is

Name	TSC Act	EPBC Act	Habitat Requirements	Likelihood of occurrence
			grasslands. Wades through shallows to hunt fish and invertebrates. Constructs a nest platform in a tree over water.	present in swamp forest.
Greater Sand Plover *Charadrius leschenaultii*	V	M	In NSW, the species has been recorded between the northern rivers and the Illawarra, with most records coming from the Clarence and Richmond estuaries. Almost entirely restricted to coastal areas in NSW, occurring mainly on sheltered sandy, shelly or muddy beaches or estuaries with large intertidal mudflats or sandbanks.	Low. Suitable habitat not present.
Grey-crowned Babbler (eastern subspecies) *Pomatostomus temporalis temporalis*	V		Occurs along the east coast of Australia. In NSW, species is known from western slopes of Great Dividing Range, western plains, Hunter Valley and north coast. Inhabits open Box-Gum Woodlands on the slopes, and Box-Cypress-pine and open Box Woodlands on alluvial plains where it forages for invertebrates. Roosts and nests in shrubs or sapling eucalypts. Generally unable to cross large open areas.	Low. Suitable habitat not present.
Little Tern *Sternula albifrons*	E	M	Migrates from eastern Asia to the north, east and south-east Australian coasts. In NSW, it arrives from September to November, occurring mainly north of Sydney, with smaller numbers found south to Victoria. Almost exclusively coastal, preferring sheltered environments. Nests in small, scattered colonies in low dunes or on sandy beaches just above high tide mark near estuary mouths or adjacent to coastal lakes and island.	Low. Suitable habitat not present.
Pale-headed Snake *Hoplocephalus bitorquatus*	V		The Pale-headed Snake has a patchy distribution from north-east Queensland to the north-eastern quarter of NSW. In NSW it has historically been recorded from as far west as Mungindi and Quambone on the Darling Riverine Plains, across the north west slopes, and from the north coast from Queensland to Sydney. The Pale-headed Snake is a highly cryptic species that can spend weeks at a time hidden in tree hollows. It is found mainly in dry eucalypt forests and woodlands, cypress forest and occasionally in rainforest or moist eucalypt forest. In drier environments, it appears to favour habitats close to riparian areas. It shelters during the	High. One record 9 km to south-west of Proposal Boundary. Potential habitat is present in open forest.

Name	TSC Act	EPBC Act	Habitat Requirements	Likelihood of occurrence
			day between loose bark and tree-trunks, or in hollow trunks and limbs of dead trees.	
Parma Wallaby *Macropus parma*	V		The Parma Wallaby is confined to the coast and ranges of central and northern NSW from the Gosford district to the Queensland border. Their preferred habitat is moist eucalypt forest with thick, shrubby understorey, often with nearby grassy areas, rainforest margins and occasionally drier eucalypt forest. They typically feed at night on grasses and herbs in more open eucalypt forest and the edges of nearby grassy areas. During the day they shelter in dense cover.	Low. Species has not been recorded for more than 20 years.
Pectoral Sandpiper *Calidris melanotos*		M	In Australasia, the Pectoral Sandpiper prefers shallow fresh to saline wetlands. The species is found at coastal lagoons, estuaries, bays, swamps, lakes, inundated grasslands, saltmarshes, river pools, creeks, floodplains and artificial wetlands.	Low. No suitable habitat within the Proposal Boundary.
Pied Oystercatcher *Haematopus longirostris*	E		The Pied Oystercatcher is distributed around the entire Australian coastline and inhabits intertidal flats of inlets and bays, open beaches and sandbanks. The species nests mostly on coastal or estuarine beaches and occasionally in saltmarsh or grassy areas.	Low. Suitable habitat not present.
Pin-tailed Snipe *Gallinago stenura*		M	The Pin-tailed Snipe breeds in Russia and migrates to south and south-east Asia. The species is vagrant to east Africa and rare in Japan. The species distribution within Australia is not well understood. There are confirmed records from NSW, including a single banded bird reported near West Wyalong. During non-breeding period the Pin-tailed Snipe occurs most often in or at the edges of shallow freshwater swamps, ponds and lakes with emergent, sparse to dense cover of grass/sedge or other vegetation.	Low. No suitable habitat within the Proposal Boundary.
Rose-crowned Fruit-Dove *Ptilinopus regina*	V		Found along the coast and ranges of eastern NSW and Queensland, from Newcastle to Cape York. Vagrants are occasionally found further south to Victoria. Occur mainly in sub-tropical and dry rainforest and occasionally in moist	Moderate. One record 8 km east of the Proposal

Name	TSC Act	EPBC Act	Habitat Requirements	Likelihood of occurrence
			eucalypt forest and swamp forest. Forage for fruit from vines, shrubs, large trees and palms, and are thought to be locally nomadic as they follow the ripening of fruits.	Boundary. Marginal habitat present in swamp forest.
Ruddy Turnstone *Arenaria interpres*		M	In Australasia, the Ruddy Turnstone is mainly found on coastal regions with exposed rock coast lines or coral reefs. It also lives near platforms and shelves, often with shallow tidal pools and rocky, shingle or gravel beaches. It can, however, be found on sand, coral or shell beaches, shoals, cays and dry ridges of sand or coral. It has occasionally been sighted in estuaries, harbours, bays and coastal lagoons, among low saltmarsh or on exposed beds of seagrass, around sewage ponds and on mudflats.	Low. No suitable habitat within the Proposal Boundary.
Scarlet Robin *Petroica boodang*	V		In NSW, the Scarlet Robin occurs from the coast to the inland slopes. The Scarlet Robin lives in dry eucalypt forests and woodlands. The understorey is usually open and grassy with few scattered shrubs. This species lives in both mature and regrowth vegetation. It occasionally occurs in mallee or wet forest communities, or in wetlands and tea-tree swamps. Scarlet Robin habitat usually contains abundant logs and fallen timber: these are important components of its habitat. The Scarlet Robin breeds on ridges, hills and foothills of the western slopes, the Great Dividing Range and eastern coastal regions; this species is occasionally found up to 1000 m in altitude. The Scarlet Robin is primarily a resident in forests and woodlands, but some adults and young birds disperse to more open habitats after breeding. In autumn and winter many Scarlet Robins live in open grassy woodlands, and grasslands or grazed paddocks with scattered trees.	High. Two records within 10 km, the closest of which is 7 km to the north-east. Potential habitat is present in forest habitats.
Sooty Oystercatcher *Haematopus fuliginosus*	V		Sooty Oystercatchers are found around the entire Australian coast. The species inhabits rocky headlands, rocky shelves, exposed reefs with rock pools, beaches and muddy estuaries. Sooty Oystercatchers breed in spring and summer, predominately on offshore islands, occasionally on isolated	Low. Suitable habitat not present.

Name	TSC Act	EPBC Act	Habitat Requirements	Likelihood of occurrence
			promontories.	
Southern Brown Bandicoot *Isoodon obesulus obesulus*	E	E	The Southern Brown Bandicoot 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.	High. One record 7.5 km east of the Proposal Boundary. Potential habitat is present in open forest.
Speckled Warbler *Chthonicola sagittata*	V		In NSW, occurs throughout the hills and tablelands of the Great Dividing Range, rarely from the coast. Inhabits Eucalyptus dominated communities that have a grassy understorey, often on rocky ridges or in gullies where it forages for insects and seeds. Nests in a depression in the ground or the base of a low dense plant, often among fallen branches and other litter.	Low. Species prefers rocky ridges and gullies.
Square-tailed Kite *Lophoictinia isura*	V		A resident of the north, north-east and along the major west-flowing river systems of NSW and a summer breeding migrant to the south-east of the state. Known from dry woodlands and open forests with a preference for timbered watercourses. Hunts for smaller birds and insects. Nests in a fork or on large horizontal limbs of trees along or near watercourses.	High. One record approximately 10 km south of the Proposal Boundary. Potential habitat is present in forest habitats.
Stephens' Banded Snake *Hoplocephalus stephensii*	V		Occurs from along the coast and ranges from southern Queensland to Gosford in NSW, in rainforest, eucalypt forests and rocky areas up to 950 m in altitude. Shelters between loose bark and tree trunks, amongst vines, or in hollow limbs, rock crevices or under slabs during the day. Hunts for frogs, lizards, birds and small mammals at night.	Low. Suitable habitat not present.
Superb Fruit-Dove *Ptilinopus superbus*	V		Occurs principally from north-eastern in Queensland to north-eastern NSW; much less common further south, where it is largely confined to pockets of suitable habitat as far south as Moruya. Inhabits rainforest and similar closed forests where it	Low. Suitable habitat not present.

Name	TSC Act	EPBC Act	Habitat Requirements	Likelihood of occurrence
			forages high in the canopy, eating the fruits of many tree species such as figs and palms. It may also forage in eucalypt or acacia woodland where there are fruit-bearing trees. At least some of the population, particularly young birds, moves south through Sydney, especially in autumn.	
Swinhoe's Snipe *Gallinago megala*		M	Swinhoe's Snipe breeds in central and southern Siberia. Its non-breeding range extends from southern China, eastern to southern India and Sri Lanka. Few definite records exist for Swinhoe's Snipe in Australia. During the non-breeding season Swinhoe's Snipe occurs at the edges of wetlands, such as wet paddy fields, swamps and freshwater streams. Habitat specific to Australia includes the dense clumps of grass and rushes round the edges of fresh and brackish wetlands.	Low. No records of this species within 10km of the search (EPBC predicted occurrence only).
White-fronted Chat *Epthianura albifrons*	V		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.	Low. Suitable habitat not present.
Wompoo Fruit-Dove *Ptilinopus magnificus*	V		Occurs along the coast and coastal ranges from the Hunter River in NSW to Cape York Peninsula. It is rare south of Coffs Harbour. Occurs in, or near rainforest, low elevation moist eucalypt forest and brush box forests. Feeds on a diverse range of tree and vine fruits and is locally nomadic - following ripening fruit. Most often seen in mature forests, but also found in remnant and regenerating rainforest.	Low. Suitable habitat not present.

Appendix C

Assessments of Significance

Swamp Sclerophyll Forest on Coastal Floodplains of the NSW North Coast, Sydney Basin and South-East Corner bioregions (SSFCF)

Swamp Sclerophyll Forest on Coastal Floodplains of the NSW North Coast, Sydney Basin and South-East Corner bioregions (SSFCF) is listed as endangered under the Threatened Species Conservation Act 1995. This community occurs in the Proposal Boundary.

(a) In the case of a threatened species, whether the action proposed is likely to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction.

Not applicable

(b) In the case of an endangered population, whether the action proposed is likely to have an adverse effect on the life cycle of the species that constitutes the endangered population such that a viable local population of the species is likely to be placed at risk of extinction.

Not applicable.

(c) In the case of an endangered ecological community or critically endangered ecological community, whether the action proposed:

> **(i) is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction, or**
>
> **(ii) is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction.**

The Proposal would require the removal of native vegetation. However, most of this is disturbed roadside vegetation, including many areas of regrowth and canopy only vegetation.

Clearing or groundcover disturbance of SSFCF (about 0.57 ha) would be required for the construction of the Proposal. 0.57 ha represents a small proportion (about 0.01%) of the distribution of the community within the locality.

Areas of SSFCF to be impacted consist of the edges of larger patches adjoining the existing road in the southern and central parts of the Proposal Boundary, and some small areas within ancillary sites. Most of the SSFCF vegetation on ancillary sites would be within construction exclusion zones.

The action is not likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction.

The SSFCF recorded within and adjoining the areas to be impacted by the Proposal is generally disturbed and fragmented, with exotic species present. Indirect impacts on retained areas of SSFCF would be avoided or minimised through implementation of mitigation measures such as fencing and sediment and erosion control.

The Proposal is not likely to adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction.

(d) In relation to a habitat of a threatened species, population or ecological community:

> **(i) the extent to which habitat is likely to be removed or modified as a result of the action proposed, and**
>
> **(ii) whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the Proposal, and**

(iii) the importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species, population or ecological community in the locality.

Clearing and groundcover disturbance of up to 0.57 ha of SSFCF would be required for construction of the Proposal. This does not represent a large proportion of the community in the locality.

The SSFCF in the Proposal Boundary is currently disturbed and fragmented. Clearing and disturbance of up to 0.57 ha of SSFCF is unlikely to result in the retained areas of the community becoming more fragmented or isolated.

The disturbed edges and fragmented patches of SSFCF to be impacted are not likely to be critical to the long-term survival of this vegetation community.

(e) Whether the action proposed is likely to have an adverse effect on critical habitat (either directly or indirectly).

To date, no critical habitat has been declared under the TSC Act for this vegetation community.

Not applicable.

(f) Whether the action proposed is consistent with the objectives or actions of a recovery plan or threat abatement plan.

To date, no recovery plan has been developed under the TSC Act for this vegetation community, however, OEH has identified five priority activities to assist this community including:

- Protect habitat by minimising further clearing of the community. This requires recognition of the values of all remnants in the land use planning process.
- Ensure that the fire sensitivity of the community is considered when planning hazard reduction and asset management burning.
- Undertake restoration including bush regeneration, revegetation and weed control, and promote public involvement in this restoration.

The Proposal is not consistent with some of these priority activities, however, mitigation measures would ensure weed control and landscaping works minimise impacts on this EEC.

(g) Whether the action proposed constitutes or is part of a key threatening process or is likely to result in the operation of, or increase the impact of, a key threatening process.

The clearing of native vegetation is listed as a key threatening process under the TSC Act. This has the potential to adversely affect Swamp Sclerophyll Forest. However, the proposed vegetation clearing is unlikely to impact important habitat for this community.

The Proposal is unlikely to have an adverse effect on Swamp Sclerophyll Forest or increase the impact of a key threatening process.

Conclusion

While the proposed works are likely to affect up to 0.57 ha of SSFCF, the limited area of disturbance and proposed mitigation strategies suggest any potential actions are unlikely to significantly affect this threatened ecological community.

A Species Impact Statement is not required.

Lower Hunter Spotted Gum Ironbark Forest of the Sydney Basin bioregion (LHSGIF)

Lower Hunter Spotted Gum Ironbark Forest is listed as endangered under the Threatened Species Conservation Act 1995. This community occurs in the Proposal Boundary.

(a) In the case of a threatened species, whether the action proposed is likely to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction.

Not applicable

(b) In the case of an endangered population, whether the action proposed is likely to have an adverse effect on the life cycle of the species that constitutes the endangered population such that a viable local population of the species is likely to be placed at risk of extinction.

Not applicable.

(c) In the case of an endangered ecological community or critically endangered ecological community, whether the action proposed:

> **(i) is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction, or**
>
> **(ii) is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction.**

The Proposal would require the removal of native vegetation. However, most of this is disturbed roadside vegetation, including many areas of regrowth and canopy only vegetation.

Two areas of LHSGIF totalling 4.09 ha in area would be required to be cleared for the design amendments and establishment of ancillary sites. The vegetation proposed to be cleared is in moderate to good condition.

Areas of LHSGIF to be impacted consist of part of the area within the Doyalson interchange and a small area on the western boundary of ancillary site W9. Most of the LHSGIF vegetation on ancillary sites would be within construction exclusion zones.

The action is not likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction.

The LHSGIF recorded within and adjoining the areas to be impacted by the Proposal is in moderate to good condition. Indirect impacts on retained areas of LHSGIF would be avoided or minimised through implementation of mitigation measures such as fencing and sediment and erosion control.

The Proposal is not likely to adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction.

(d) In relation to a habitat of a threatened species, population or ecological community:

> **(i) the extent to which habitat is likely to be removed or modified as a result of the action proposed, and**
>
> **(ii) whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the Proposal, and**

(iii) the importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species, population or ecological community in the locality.

Clearing and groundcover disturbance of up to 4.09 ha of LHSGIF would be required for construction of the Proposal. This does not represent a large proportion of the community in the locality.

The LHSGIF in the Proposal Boundary is in moderate to good condition, although it is fragmented by existing roads. Clearing and disturbance of up to 4.09 ha of LHSGIF is unlikely to result in the retained areas of the community becoming more fragmented or isolated.

The patches of LHSGIF to be impacted are not likely to be critical to the long-term survival of this vegetation community in the locality.

(e) Whether the action proposed is likely to have an adverse effect on critical habitat (either directly or indirectly).

To date, no critical habitat has been declared under the TSC Act for this vegetation community.

Not applicable.

(f) Whether the action proposed is consistent with the objectives or actions of a recovery plan or threat abatement plan.

To date, no recovery plan has been developed under the TSC Act for this vegetation community, however, OEH has identified five priority activities to assist this community including:

- Protect habitat by minimising further clearing of the community. This requires recognition of the values of all remnants in the land use planning process, particularly development consents, rezonings and regional planning.
- Weed control.
- Undertake restoration including bush regeneration and revegetation.

The Proposal is not consistent with some of these priority activities, however, mitigation measures would ensure weed control and landscaping works minimise impacts on this EEC.

(g) Whether the action proposed constitutes or is part of a key threatening process or is likely to result in the operation of, or increase the impact of, a key threatening process.

The clearing of native vegetation is listed as a key threatening process under the TSC Act. This has the potential to adversely affect LHSGIF. However, the proposed vegetation clearing is unlikely to impact important habitat for this community, with minimal clearing (4.09 ha) for interchange upgrades and ancillary sites.

The Proposal would result in a minor increase to the impact from this key threatening process.

Conclusion

While the cumulative impacts are likely to affect up to 4.09 ha of LHSGIF the limited area of disturbance and proposed mitigation strategies suggest any potential actions are unlikely to significantly affect this threatened ecological community. It is recommended that as greater than one hectare of this EEC is likely to be affected, offsets are considered in accordance with the Roads and Maritime Guideline for Biodiversity Offsets.

A Species Impact Statement is not required

Grevillea parviflora subsp. *parviflora* (Small-flowered Grevillea)

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

(a) In the case of a threatened species, whether the action proposed is likely to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction.

Grevillea parviflora subsp. *parviflora* is distributed sporadically throughout the Sydney Basin with two disjunct, separate regional populations on the Central Coast and in the Lower Hunter.

The biology and ecology of Small-flower Grevillea is poorly known. Flowering occurs mainly between July and December, flowers are insect pollinated and there is limited seed dispersal (DSEWPAC 2014). The plant can sucker readily from rhizomes making individuals sometimes difficult to count.

All populations should be assumed to be viable (NPWS 2002). Sites of particular significance for the species would include any population with greater than 50 plants, varied age structure and an area of intact habitat away from high disturbance areas (NPWS 2002, DSEWPAC 2014).

This species was recorded within the Proposal Boundary during seasonal field survey at two locations north-west of the Warnervale Interchange (SMEC 2014).

It is considered that a 500m gap between populations may represent a distinct population; this distance is based on the maximum flight distance of pollinators (LMCC 2013a). From desktop assessment, SMEC (2014) assumed the *G. parviflora* subsp. *parviflora* population recorded north-west of the Warnervale Interchange is a distinct population due to an absence of any further records within a 500 m radius.

SMEC (2014) proposed that exclusion zones would be established to avoid impacts on individuals of this species and that no vegetation would be removed within a 20 m buffer of known *G. parviflora* subsp. *parviflora* records north-west of the Warnervale Interchange. This has been amended as the previously proposed 25 m radius exclusion zones for threatened plants would be unachievable. The exclusion zones have been reduced from 25 m to 5, 15 and 17 m, however no *G. parviflora* subsp. *parviflora* would be directly impacted as a result of this change.

The action is not likely to effect the life cycle of these species such that a viable local population is placed at risk of extinction.

(b) In the case of an endangered population, whether the action proposed is likely to have an adverse effect on the life cycle of the species that constitutes the endangered population such that a viable local population of the species is likely to be placed at risk of extinction.

Not applicable.

(c) In the case of an endangered ecological community or critically endangered ecological community, whether the action proposed:

> **(i) is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction, or**
>
> **(ii) is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction.**

Not applicable.

(d) In relation to a habitat of a threatened species, population or ecological community:

(i) the extent to which habitat is likely to be removed or modified as a result of the action proposed, and

(ii) whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the Proposal, and

(iii) the importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species, population or ecological community in the locality.

Potential habitat in the Proposal Boundary would be removed, although none of the occupied habitat would be affected. It is proposed that exclusion zones are established to avoid impacts on individuals of this species.

Mitigation measures recommend avoiding impacts to this species where there are known records and limiting clearing of potential habitat wherever possible.

The extent of habitat to be removed is small relative to the known extent of habitat remaining in the locality. The removal of habitat for this Proposal is not considered to be significant to the long term survival of this species.

The proposed activity would marginally increase the distance between remaining habitat areas of *G. parviflora* subsp. *parviflora.* The occupied habitat for *G. parviflora* subsp. *parviflora* in the Proposal Boundary is already fragmented by the existing road network and surrounding clearing and disturbance.

The habitat to be removed is not likely to be critical to the long-term survival of the species.

(e) Whether the action proposed is likely to have an adverse effect on critical habitat (either directly or indirectly).

To date, no critical habitat has been declared under the TSC Act for this species.

Not applicable.

(f) Whether the action proposed is consistent with the objectives or actions of a recovery plan or threat abatement plan.

To date, no recovery plan has been developed under the TSC Act for this threatened species, however OEH has identified eight priority activities to assist this species:

- Ensure that personnel planning and undertaking road maintenance are able to identify the species and are aware of its habitat.
- Reinstate an appropriate fire regime (either restrict fire or undertake ecological burns as required).
- Ensure that this species is considered in all planning matters on land that contains or may contain populations
- Mark and fence off sites during development/road maintenance activities.
- Undertake weed control using methods that would not impact on populations of *G. parviflora* subsp. *parviflora* (avoid spraying in the vicinity of the plants and either hand pull weeds or cut and paint them).
- Ensure these populations and habitat are protected.
- Mark known sites and potential habitat onto maps used for planning maintenance work.

- Conduct searches in potential habitat for new populations
- The Proposal is consistent with these priority activities.

(g) Whether the action proposed constitutes or is part of a key threatening process or is likely to result in the operation of, or increase the impact of, a key threatening process.

The clearing of native vegetation is listed as a key threatening process under the TSC Act. This has the potential to adversely affect this species. In this case it is expected that vegetation clearing is not likely to have an impact upon an important habitat for this species as the majority of vegetation removal would occur within previously disturbed areas.

The Proposal is unlikely to have an adverse effect on this species or significantly increase the impact of a key threatening process.

Conclusion

Grevillea parviflora subsp. *parviflora* species was recorded in the Proposal Boundary during targeted field survey. The proposed actions would require the removal of native vegetation within the Proposal Boundary that constitutes potential habitat for this species. No individuals of the species would be removed.

It is proposed that exclusion zones are established to avoid impacts on individuals of this species. Providing this is implemented the Proposal is unlikely to significantly affect this species.

A Species Impact Statement is not required.

Rutidosis heterogama (Heath Wrinklewort) *Pimelea curviflora var. curviflora, Acacia bynoeana* (Bynoe's Wattle), *Cryptostylis hunteriana* (Leafless Tongue Orchid)

Grouping: Groundcover and low shrub in heath and shrubby woodland to open forest on sand or sandy clay substrate

Rutidosis heterogama, *Pimelea curviflora* var. *curviflora*, and *Cryptostylis hunteriana* are all listed as Vulnerable under the TSC Act. *Acacia bynoeana* is listed as Endangered under the TSC Act.

(a) In the case of a threatened species, whether the action proposed is likely to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction.

No individuals of these species were identified during the onsite surveys. The original Project REF and Proposal would require the removal of native vegetation. However, most of this is disturbed roadside vegetation, including many areas of regrowth and canopy only vegetation.

Up to about 14.35 ha of potential habitat for these four species may be cleared or disturbed as a result of the Proposal.

The Proposal is not likely to affect the life cycle of these species such that viable local populations are placed at risk of extinction.

(b) In the case of an endangered population, whether the action proposed is likely to have an adverse effect on the life cycle of the species that constitutes the endangered population such that a viable local population of the species is likely to be placed at risk of extinction.

Not applicable.

(c) In the case of an endangered ecological community or critically endangered ecological community, whether the action proposed:

> **(i) is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction, or**
>
> **(ii) is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction.**

Not applicable.

(d) In relation to a habitat of a threatened species, population or ecological community:

> **(i) the extent to which habitat is likely to be removed or modified as a result of the action proposed, and**
>
> **(ii) whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the Proposal, and**
>
> **(iii) the importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species, population or ecological community in the locality.**

Up to about 14.35 ha of potential habitat for these species is proposed to be cleared as a result of the Proposal. Most of this habitat currently adjoins the road and is disturbed and edge-

effected. The clearing of up to 14.35 ha of potential habitat for the construction of the Proposal is unlikely to impact important habitat for these species.

No individuals of these species were identified during the onsite surveys.

Clearing is unlikely to fragment or isolate habitat for these species, with the majority of vegetation to be removed being in the existing previously disturbed median strip of the M1 Pacific Motorway.

(e) Whether the action proposed is likely to have an adverse effect on critical habitat (either directly or indirectly).

To date, no critical habitat has been declared under the TSC Act for this species.

Not applicable.

(f) Whether the action proposed is consistent with the objectives or actions of a recovery plan or threat abatement plan.

To date, no recovery plan has been developed under the TSC Act for these threatened species.

(g) Whether the action proposed constitutes or is part of a key threatening process or is likely to result in the operation of, or increase the impact of, a key threatening process.

The clearing of native vegetation is listed as a key threatening process under the TSC Act. This has the potential to adversely affect these species. However, vegetation clearing is unlikely to impact important habitat for this species, with the majority of vegetation to be removed exotic or in previously disturbed areas.

The Proposal is unlikely to have an adverse effect on these species or significantly increase the impact of a key threatening process.

Conclusion

While there is potential for these species to occur within the Proposal Boundary, no species were identified and the proposed works are not likely to impact on their long term survival.

A Species Impact Statement is not required.

References

OEH 2015 Heath Wrinklewort Threatened Species Profile. Accessed 21st August 2015 http://www.environment.nsw.gov.au/threatenedSpeciesApp/profile.aspx?id=10737

OEH 2015 *Pimelea curviflora* var. *curviflora* Threatened Species Profile. Accessed 21st August 2015 http://www.environment.nsw.gov.au/threatenedSpeciesApp/profile.aspx?id=10629

OEH 2015 Leafless Tongue-orchid Threatened Species Profile. Accessed 21st August 2015 http://www.environment.nsw.gov.au/threatenedSpeciesApp/profile.aspx?id=10187

OEH 2015 Bynoe's Wattle Threatened Species Profile. Accessed 21st August 2015 http://www.environment.nsw.gov.au/threatenedSpeciesApp/profile.aspx?id=10006

Eucalyptus parramattensis C. Hall. subsp. *parramattensis* In Wyong and Lake Macquarie Local Government Areas, *Melaleuca biconvexa* (Biconvex Paperbark), and *Angophora inopina* (Charmhaven Apple)

Grouping: Grows in damp places, often near streams or low-lying areas. The site is considered to provide suitable habitat for these species.

Eucalyptus parramattensis subsp. *parramattensis* in the Wyong and Lake Macquarie Local Government Area is listed as an endangered population under the Threatened Species Conservation Act 1995.

Eucalyptus parramattensis subsp. *parramattensis* was not recorded in the Proposal Boundary and therefore should not be impacted by the Proposal.

Melaleuca biconvexa (Biconvex Paperbark) and *Angophora inopina* (Charmhaven Apple) are listed as Vulnerable species under the TSC Act.

Two individuals of *Angophora inopina* (Charmhaven Apple) were recorded at ancillary site W8, while a stand of *Melaleuca biconvexa* (Biconvex Paperbark) was recorded at proposed ancillary site W9.

(a) In the case of a threatened species, whether the action proposed is likely to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction.

Two isolated individuals of *Angophora inopina* located within cleared exotic-dominated grassland in ancillary site W8 would be removed for construction of the Proposal. A small stand of *Melaleuca biconvexa* is located within Site W9. Although these trees are not proposed to be cleared as part of the Proposal, given the proximity of works, exclusion zones would be established as a precautionary measure to avoid impacts on individuals of this species.

Potential habitat for the three species would be cleared for construction of the Proposal; up to 1.41 ha of floodplain vegetation communities which may form habitat for the species would be directly impacted.

The action is not likely to affect the life cycle of these species such that a viable local population is placed at risk of extinction.

(b) In the case of an endangered population, whether the action proposed is likely to have an adverse effect on the life cycle of the species that constitutes the endangered population such that a viable local population of the species is likely to be placed at risk of extinction.

Eucalyptus parramattensis subsp. *parramattensis* is an endangered population within the Wyong LGA. This species was not recorded within the Proposal Boundary. Potential habitat to be removed for this species is up to approximately 1.41 ha.

(c) In the case of an endangered ecological community or critically endangered ecological community, whether the action proposed:

> **(i) is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction, or**
>
> **(ii) is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction.**

Not applicable.

(d) In relation to a habitat of a threatened species, population or ecological community:

(i) the extent to which habitat is likely to be removed or modified as a result of the action proposed, and

(ii) whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the Proposal, and

(iii) the importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species, population or ecological community in the locality.

The Proposal would require the removal of native vegetation. However, most of this is disturbed roadside vegetation, including many areas of regrowth and canopy only vegetation. Potential habitat for the three species would be cleared for construction of the Proposal; up to 1.41 ha of floodplain vegetation communities which may form habitat for the species would be directly impacted.

Two isolated individuals of *Angophora inopina* located within cleared exotic-dominated grassland in ancillary site W8 would be removed for construction of the Proposal. A small stand of *Melaleuca biconvexa* is located within Site W9. Although these trees are not proposed to be cleared as part of the Proposal, given the proximity of works, exclusion zones would be established as a precautionary measure to avoid impacts on individuals of this species.

The potential habitat for the species to be removed is not likely to be critical to the long-term survival of these species.

(e) Whether the action proposed is likely to have an adverse effect on critical habitat (either directly or indirectly).

To date, no critical habitat has been declared under the TSC Act for this species.

Not applicable.

(f) Whether the action proposed is consistent with the objectives or actions of a recovery plan or threat abatement plan.

To date, no recovery plan has been developed under the TSC Act for these threatened species. OEH have identified seven priority activities to assist Biconvex Paperbark including:

- Survey thoroughly for the presence of Biconvex Paperbark before the approval of development applications.
- Ensure run-off into swamps is controlled.
- Assess impact of myrtle rust through monitoring of populations in proximity to known infestations.

(g) Whether the action proposed constitutes or is part of a key threatening process or is likely to result in the operation of, or increase the impact of, a key threatening process.

The clearing of native vegetation is listed as a key threatening process under the TSC Act. This has the potential to adversely affect these species. However, vegetation clearing is unlikely to impact important habitat for this species, with the majority of vegetation to be removed exotic or in previously disturbed areas.

The Proposal is unlikely to have an adverse effect on these species or significantly increase the impact of a key threatening process.

Conclusion

While there is potential for these species to occur within a small area of the site, no E*ucalyptus parramattensis* subsp. *parramattensis* were recorded within the Proposal Boundary. Two individuals of *Angophora inopina* were identified on a proposed ancillary site and would be directly impacted, while a grove of *Melaleuca biconvexa* recorded at an adjacent proposed ancillary site would not be removed but may be subject to indirect impacts. Exclusion zones would be established around these threatened species to reduce the likelihood of inadvertent impacts to these threatened species as a precautionary measure.

A Species Impact Statement is not required**.**

References

OEH 2015 Biconvex Paperbark Threatened Species Profile. Accessed 21st August 2015 http://www.environment.nsw.gov.au/threatenedSpeciesApp/profile.aspx?id=10514

OEH 2015 Charmhaven Apple Threatened Species Profile. Accessed 21st August 2015 http://www.environment.nsw.gov.au/threatenedspeciesapp/profile.aspx?id=10053

Tetratheca juncea (Black-eyed Susan)

Tetratheca juncea is listed as a vulnerable species under the TSC Act. *T. juncea* is known to exist only from the Wyong area to Bulahdelah and inland to the edge of the main ranges with the greatest concentration of records being from the Wyong and Lake Macquarie Local Government Areas.

(a) In the case of a threatened species, whether the action proposed is likely to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction.

Tetratheca juncea is known found in sandy, occasionally moist heath and in dry sclerophyll vegetation. The total population size of Black-eyed susan is difficult to estimate accurately due to the species' habit of clumping. Plant clumps are commonly counted during survey work and used as a surrogate for individual plants. The total population size of Black-eyed Susan has previously been estimated to be between 9,881 and 11,893 plant clumps (approximately 10,000 individuals). It is estimated there are 162 subpopulations in the Wyong LGA.

Individual plants are difficult to identify given the plant is clonal and would resprout from rootstock. Little more is known about the life cycle of the species, however, recent research (Driscoll 2009) suggests that the plant is slow growing, with local populations/patches of the plant possibly being a hundred or more years old (Driscoll 2009). Evidence from historical urban development and rural land clearing indicates that the species continues to exist despite large losses from a local population (Driscoll 2009).

A local population includes a subpopulation. It is considered that a 500 m gap between populations may represent a distinct population; this distance is based on the maximum flight distance of pollinators (LMCC 2014). From desktop assessment it is assumed any *Tetratheca juncea* population present within Site 1c is a distinct population with an absence of any further existing records within a 500 m radius.

The Proposal would directly impact up to two plant clumps located along the current road edge which occur within a 20 m buffer of the proposed construction impact area and exclusion zones are not achievable.

The action is not likely to affect the life cycle of this species such that a viable local population is placed at risk of extinction.

(b) In the case of an endangered population, whether the action proposed is likely to have an adverse effect on the life cycle of the species that constitutes the endangered population such that a viable local population of the species is likely to be placed at risk of extinction.

Not applicable.

(c) In the case of an endangered ecological community or critically endangered ecological community, whether the action proposed:

> **(i) is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction, or**
>
> **(ii) is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction.**

Not applicable.

(d) In relation to a habitat of a threatened species, population or ecological community:

(i) the extent to which habitat is likely to be removed or modified as a result of the action proposed, and

(ii) whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the Proposal, and

(iii) the importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species, population or ecological community in the locality.

There is approximately 9 ha of potential habitat in the Proposal Boundary to be removed including about 0.41 ha of known habitat in Site 1c. Modelled habitat for the *Tetratheca juncea* Central Coast meta-population is about 25,716 ha remaining (Driscoll 2012, LMCC 2013). Total potential habitat to be cleared in the Proposal Boundary represents about 0.03% of the remaining potential habitat in the region.

It is proposed that the presence of the species is confirmed during flowering season and additional searches of Site 1c are undertaken. Exclusion zones should be established to avoid impacts on individuals of this species.

Mitigation measures recommend avoiding impacts to this species where there are known records and limiting clearing of potential habitat wherever possible.

Habitat to be removed is a small area considering the extent of habitat remaining in the locality and is not considered significant to the long term survival of this species.

Tetratheca juncea habitat in the Proposal Boundary is already fragmented by the existing M1 Pacific Motorway and supporting road network. The Proposal would marginally increase the distance between remaining habitat areas of *Tetratheca juncea*. From desktop assessment it is assumed any *Tetratheca juncea* population present within Site 1c is a distinct, already isolated population with an absence of any further existing records within a 500 m radius.

Mitigation measures recommend avoiding impacts to this species where there are known records and limiting clearing of potential habitat wherever possible.

The potential habitat to be removed is likely to result in a minor increase in fragmentation to areas of habitat for this species.

The habitat to be removed is not likely to be critical to the long-term survival of the species.

(e) Whether the action proposed is likely to have an adverse effect on critical habitat (either directly or indirectly).

To date, no critical habitat has been declared under the TSC Act for this species.

Not applicable.

(f) Whether the action proposed is consistent with the objectives or actions of a recovery plan or threat abatement plan.

To date, no recovery plan has been developed under the TSC Act for these threatened species. OEH have identified six priority activities to assist this species including:

- Undertake targeted searches for the species in known or potential habitat during its flowering period prior to any clearing or development.
- Install stormwater control mechanisms to prevent offsite impacts from development upslope of populations.
- Undertake weed control as required using removal methods that would not impact on the species (hand pull or cut and paint weeds).

The Proposal is consistent with these activities.

(g) Whether the action proposed constitutes or is part of a key threatening process or is likely to result in the operation of, or increase the impact of, a key threatening process.

The clearing of native vegetation is listed as a key threatening process under the TSC Act. This has the potential to adversely affect these species. However, vegetation clearing is unlikely to impact important habitat for this species, with the majority of vegetation to be removed exotic or in previously disturbed areas.

The Proposal is unlikely to have an adverse effect on these species or significantly increase the impact of a key threatening process.

Conclusion

This species was recorded in the Proposal Boundary during field survey. The Proposal would require the removal of native vegetation (about 0.4 ha) in Site 1c that could indirectly impact this species as well as clumps of individuals currently along the road edge.

It is proposed that the presence of the species is confirmed during flowering season. Exclusion zones should be established to avoid impacts on individuals of this species. As long as these mitigation measures are implemented, the Proposal is unlikely to significantly affect this species. A Species Impact Statement is not required

References

Driscoll (2009) *A review of the ecology and biology of* Tetratheca juncea *Sm. (Elaeocarpaceae).* Draft report to Lake Macquarie City Council.

Lake Macquarie City Council (LMCC) (2014) *Lake Macquarie* Tetratheca juncea *Planning and Management Guidelines.*

OEH (2015) Black-eyed Susan Threatened Species Profile. Accessed 21st August 2015 http://www.environment.nsw.gov.au/threatenedSpeciesApp/profile.aspx?id=10799

Thelymitra sp. *adorata* (Wyong Sun Orchid)

Thelymitra sp. *adorata* is listed as Critically Endangered under the TSC Act.

(a) In the case of a threatened species, whether the action proposed is likely to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction.

Thelymitra sp. *adorata* is a ground orchid up to 60 cm tall with a single leaf. The species is currently known from a few localised occurrences in the central coast region, between the towns of Wyong, Warnervale and Wyongah. The following is known about the life cycle of *Thelymitra* sp. *adorata* (OEH 2011):

- Plants occur in small isolated colonies of a few to about 25m^2 extent.
- Flowers are produced in September and October; not all plants flower every year.
- The species is probably autogamous (self-pollinating).
- Fruits are developed in October and November.
- Longevity of individual plants, and rate of tuber exhaustion, are unknown.
- Fire response is unknown, but the tubers probably survive low-intensity fires.

No individuals of *Thelymitra* sp. *adorata* were identified during the onsite surveys.

The Proposal would require the removal of native vegetation. However, most of this is disturbed roadside vegetation, including many areas of regrowth and canopy only vegetation.

The action is not likely to effect the life cycle of this species such that a viable local population is placed at risk of extinction.

(b) In the case of an endangered population, whether the action proposed is likely to have an adverse effect on the life cycle of the species that constitutes the endangered population such that a viable local population of the species is likely to be placed at risk of extinction.

Not applicable.

(c) In the case of an endangered ecological community or critically endangered ecological community, whether the action proposed:

> **(i) is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction, or**
>
> **(ii) is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction.**

Not applicable.

(d) In relation to a habitat of a threatened species, population or ecological community:

> **(i) the extent to which habitat is likely to be removed or modified as a result of the action proposed, and**
>
> **(ii) whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the Proposal, and**
>
> **(iii) the importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species, population or ecological community in the locality.**

No individuals were identified during the onsite surveys. The majority of populations of *Thelymitra* sp. *adorata* occur in Spotted Gum - Ironbark Forest with a diverse grassy understorey and occasional scattered shrubs; the Narrabeen Dooralong Spotted Gum – Ironbark Forest mapped in the Proposal Boundary is considered to form potential habitat for the species.

Clearing and groundcover disturbance of up to 4.36 ha of Narrabeen Dooralong Spotted Gum – Ironbark Forest would be required for construction of the Proposal. This does not represent a large proportion of potential habitat for the species in the locality, and some of the areas to be impacted form the edges of relatively undisturbed larger areas of remnant Spotted Gum-Ironbark forest which represents potential habitat.

(e) Whether the action proposed is likely to have an adverse effect on critical habitat (either directly or indirectly).

To date, no critical habitat has been declared under the TSC Act for this species.

Not applicable.

(f) Whether the action proposed is consistent with the objectives or actions of a recovery plan or threat abatement plan.

To date, no recovery plan has been developed under the TSC Act for this threatened species.

To date, no recovery plan has been developed under the TSC Act for this threatened species, however OEH has identified six activities to assist this species:

- Control invasive weeds species which threaten to outcompete the Wyong Sun Orchid.
- Conduct targeted surveys for the species in September and October in areas where further development is planned so as to ensure that no further habitat is lost to development.
- Eliminate grazing by cattle and horses in known populations.
- Avoid above ground growth phase (May to late November), when undertaking maintenance activities
- Protect populations from vehicular traffic
- Develop and implement appropriate fire regimes

The Proposal is consistent with these activities.

(g) Whether the action proposed constitutes or is part of a key threatening process or is likely to result in the operation of, or increase the impact of, a key threatening process.

The clearing of native vegetation is listed as a key threatening process under the TSC Act. This has the potential to adversely affect *Thelymitra* sp. *adorata*. In this case it is expected that vegetation clearing is not likely to have an impact upon an important habitat for this species as the majority of vegetation removal would occur within previously disturbed areas.

The Proposal is unlikely to have an adverse effect on this species or significantly increase the impact of a key threatening process.

Conclusion

While there is potential for these species to occur within a small part of the Proposal Boundary, no *Thelymitra* sp. *adorata* was recorded during on-site surveys and the proposed works are not likely to impact on their long term survival.

A Species Impact Statement is not required.

Squirrel Glider (*Petaurus norfolcensis*)

The Squirrel Glider is listed as Vulnerable under the TSC Act. This species is known to occur within the area with over 100 individuals recorded in the locality (OEH 2015). These records predominantly occur to the east of the M1 Pacific Motorway with only five records occurring west near Jiliby SCA. One individual was recorded as road kill near Wyong River in 2004.

This species requires abundant hollow bearing trees for shelter, nesting and breeding, and a mix of eucalypts, acacias and banksias to meet feeding requirements.

(a) In the case of a threatened species, whether the action proposed is likely to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction.

Squirrel Glider foraging resources are found throughout the Open Forest and Swamp Forest communities within the Proposal Boundary. Hollow bearing trees are scattered located along the road corridor and occur in high densities in some ancillary sites. Where feasible hollow bearing trees throughout the Proposal Boundary would be avoided.

These trees may provide nesting and or refuge hollows for the Squirrel Glider. The Proposal may result in disruption to breeding activities through direct removal of potential nesting or refuge hollows if undertaken during the breeding season (June - January). If Squirrel Gliders are present during tree removal there is the risk of injury and mortality to individuals.

Construction noise and increased activities in the proximity to breeding or denning hollows may also indirectly lead to reduced breeding success through nest abandonment and individuals being displaced through loss of denning sites. Although tree hollows are a critical resource for this species, Squirrel Gliders often nest in family groups and would rely on several tree hollows for refuge within a territory. The removal of 12 hollow-bearing trees from theProposal Boundary, and a number of hollow-bearing trees from the original Project REF Boundary, is a small proportion of the number of hollows present within the greater locality, and although it would reduce the number of tree hollows available it is unlikely to place a local population of Squirrel Gliders at risk of extinction.

(b) In the case of an endangered population, whether the action proposed is likely to have an adverse effect on the life cycle of the species that constitutes the endangered population such that a viable local population of the species is likely to be placed at risk of extinction.

Not applicable.

(c) In the case of an endangered ecological community or critically endangered ecological community, whether the action proposed:

> **(i) is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction, or**
>
> **(ii) is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction.**

Not applicable.

(d) In relation to a habitat of a threatened species, population or ecological community:

> **(i) the extent to which habitat is likely to be removed or modified as a result of the action proposed, and**
>
> **(ii) whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the Proposal, and**

(iii) the importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species, population or ecological community in the locality.

Squirrel Gliders can inhabit a diverse range of vegetation communities, with a preference for dry sclerophyll forests and woodland over closed forests and rainforest communities.

The Proposal would remove approximately b0.04 ha of potential foraging habitat.

Nesting and denning habitat (tree hollows) are proposed to be removed from the Proposal boundary.

Squirrel Gliders are capable of gliding more than 50 m in one glide and are capable of nightly foraging movements between 300-500 m. Home ranges can vary greatly (between 0.65 and 8.5 ha) and juveniles disperse after approximately 1 year. Records of Squirrel Gliders largely occur to the east of the M1 Pacific Motorway with no recent records occurring to the west of the M1 Pacific Motorway\. Based on the distribution of records it is presumed that the current M1 Pacific Motorway poses a significant barrier to movement for the Squirrel Glider.

The riparian vegetation along Wyong River may provide connectivity for the Squirrel Glider. The Proposal does not require the removal of riparian vegetation to install the Wyong Spill Containment.

Given the mobility of the species and the limited amount of habitat to be modified, it is unlikely that that Squirrel Glider habitat would become fragmented or isolated from other areas of habitat as a result of the proposed actions.

Vegetation to be removed is disturbed or partially modified and is likely to provide sub- optimal habitat for the Squirrel Glider. The vegetation to be retained within the Proposal Boundary is much higher quality and more capable of supporting individuals. The habitat to be removed/modified is not likely to be of importance to the long-term survival of this species.

(e) Whether the action proposed is likely to have an adverse effect on critical habitat (either directly or indirectly).

To date, no critical habitat has been declared under the TSC Act for this species.

Not applicable.

(f) Whether the action proposed is consistent with the objectives or actions of a recovery plan or threat abatement plan.

A recovery plan is currently being developed for this species. Management strategies to protect this species include habitat protection and maintenance, introduced animal control programs and the maintenance and enhancement of floristic and structural diversity of Squirrel Glider vegetation through the alteration of prescribed burning and grazing regimes.

The Proposal is largely consistent with the priority management strategies proposed for this species through the retention of good quality remnant vegetation patches and maintenance of exclusions zones within riparian vegetation of Wyong River to maintain connectivity for this species. The Proposal involves the removal of some tree hollows which is not consistent with priority management strategies for this species.

(g) Whether the action proposed constitutes or is part of a key threatening process or is likely to result in the operation of, or increase the impact of, a key threatening process.

The clearing of native vegetation and loss of hollow-bearing trees are listed as key threatening processes under the TSC Act. This has the potential to adversely affect Squirrel Gliders through

the loss of foraging resources and potential nesting habitat. However, vegetation clearing is unlikely to impact important habitat for the species.

The Proposal is unlikely to significantly increase the impact of the key threatening processes.

Conclusion

Given these species high mobility, the retention of hollow bearing trees and remnant vegetation, the Proposal is unlikely to significantly impact the Squirrel Glider.

A Species Impact Statement is not required.

References

OEH 2015 Squirrel Glider Threatened Species Profile. Accessed 21st August 2015 http://www.environment.nsw.gov.au/threatenedspeciesapp/profile.aspx?id=10604

Eastern false pipistrelle (*Falsistrellus tasmaniensis*), Little Bentwing-bat (*Miniopterus australis*), Eastern Freetail-bat (*Mormopterus norfolkensis*), Yellow-bellied Sheathtail-bat (*Saccolaimus flaviventris*), Greater broad- nosed bat (*Scoteanax rueppellii*) and Golden-tipped Bat (*Kerivoula papuensis*)

Grouping: Primarily forest-dwelling microbat

The Eastern False Pipistrelle, Little Bentwing Bat, Eastern Freetail- bat, Yellow-bellied Sheathtail-bat, Greater-broad-nosed bat and Golden-tipped Bat are all listed as Vulnerable under the TSC Act.

The Little Bentwing Bat uses tunnels and caves as well as tree hollows for nesting, the Golden-tipped Bat roosts in gullies in rainforest, while the remaining species require hollow bearing trees for shelter, nesting and breeding, and forage throughout the Open Forest, Swamp Forest and over the Aquatic habitats within the Proposal Boundary.

(a) In the case of a threatened species, whether the action proposed is likely to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction.

The majority of these species may roost and / or breed within tree hollows within the Proposal Boundary. The Proposal would result in the removal of a number of tree hollows from the Proposal Boundary. Where feasible hollow bearing trees throughout the Proposal Boundary would be avoided. No breeding habitat for the Golden-tipped Bat would be impacted by the Proposal.

The proposed actions are unlikely to have an adverse impact on the life cycle of these species such that a viable local population would be placed at risk of extinction

(b) In the case of an endangered population, whether the action proposed is likely to have an adverse effect on the life cycle of the species that constitutes the endangered population such that a viable local population of the species is likely to be placed at risk of extinction.

Not applicable.

(c) In the case of an endangered ecological community or critically endangered ecological community, whether the action proposed:

> **(i) is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction, or**
>
> **(ii) is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction.**

Not applicable.

(d) In relation to a habitat of a threatened species, population or ecological community:

> **(i) the extent to which habitat is likely to be removed or modified as a result of the action proposed, and**
>
> **(ii) whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the Proposal, and**

(iii) the importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species, population or ecological community in the locality.

The Proposal would require the removal of potential foraging habitat. However, most of this vegetation is confined to the median strip of the existing M1 Pacific Motorway. Mitigation measures include the retention of hollow bearing trees throughout the Proposal Boundary where feasible. There would be some loss of potential breeding and foraging habitat for these species, but the sections of Proposal Boundary that would be affected are unlikely to provide important habitat for these bats.

These microbat species are capable of dispersing large distances and as such have large home ranges.

Given the species are highly mobile and only a small amount of potential habitat is to be removed/modified, it is unlikely the microbat habitat within the Proposal Boundary would become fragmented or isolated as a result of the proposed actions.

Given the relatively small amount of habitat to be removed as a result of the Proposal (and the currently fragmented nature of much of the Proposal Boundary, it is unlikely that any habitat to be removed is important to the long-term survival of any of these species.

It is unlikely that any habitat to be removed is important to the long-term survival of any of these species.

(e) Whether the action proposed is likely to have an adverse effect on critical habitat (either directly or indirectly).

To date, no critical habitat has been declared under the TSC Act for this species.

Not applicable.

(f) Whether the action proposed is consistent with the objectives or actions of a recovery plan or threat abatement plan.

No recovery plans have been developed for any of the five microbat species. Not applicable.

(g) Whether the action proposed constitutes or is part of a key threatening process or is likely to result in the operation of, or increase the impact of, a key threatening process.

The clearing of native vegetation is listed as a key threatening process under the TSC Act. The Proposal would involve the operation of this key threatening process, though it is expected that the overall impact upon forest-dwelling bats in the area would be minor due to the relatively small amount of clearing required and the variable condition of existing vegetation communities in the area.

The loss of hollow-bearing trees is also listed as a key threatening process under the TSC Act. The Proposal would involve the operation of this key threatening process through the removal of up to 12 hollow-bearing trees.

The proposed actions are likely to result in a minor increase in the operation of a key threatening process.

Conclusion

There is limited suitable foraging and roosting habitat within the Proposal Boundary for these six threatened microbat species. While the proposed works would affect some potential foraging habitat, the limited area of disturbance and proposed mitigation strategies suggest any potential actions are unlikely to have an overall significant impact upon these species.

A Species Impact Statement is not required.

References

OEH 2015 Broad-nosed Bat Threatened Species Profile. Accessed 21st August 2015 http://www.environment.nsw.gov.au/threatenedspeciesapp/profile.aspx?id=10748

OEH 2015 Eastern False Pipistrelle Threatened Species Profile. Accessed 21st August 2015 http://www.environment.nsw.gov.au/threatenedspeciesapp/profile.aspx?id=10331

OEH 2015 Eastern Freetail Bat Threatened Species Profile. Accessed 21st August 2015 http://www.environment.nsw.gov.au/threatenedSpeciesApp/profile.aspx?id=10544

OEH 2015 Yellow-bellied Sheathtail Bat Threatened Species Profile. Accessed 21st August 2015 http://www.environment.nsw.gov.au/threatenedspeciesapp/profile.aspx?id=10741

OEH 2015 Little Bentwing Bat Threatened Species Profile. Accessed 21st August 2015 http://www.environment.nsw.gov.au/threatenedspeciesapp/profile.aspx?id=10533

OEH 2015 Golden-tipped Bat Threatened Species Profile. Accessed 2nd October 2015 http://www.environment.nsw.gov.au/threatenedspeciesapp/profile.aspx?id=10444

Eastern Bentwing-bat (*Miniopterus schreibersii oceanensis*)

This microbat species is listed as Vulnerable under the TSC Act.

(a) In the case of a threatened species, whether the action proposed is likely to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction.

No roosting structures or maternity caves have been identified within the Proposal Boundary, though there is the potential for this species to roost within existing culverts. The proposed actions are unlikely to have an adverse impact on the life cycle of this species such that a viable local population would be placed at risk of extinction

(b) In the case of an endangered population, whether the action proposed is likely to have an adverse effect on the life cycle of the species that constitutes the endangered population such that a viable local population of the species is likely to be placed at risk of extinction.

Not applicable.

(c) In the case of an endangered ecological community or critically endangered ecological community, whether the action proposed:

> **(i) is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction, or**
>
> **(ii) is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction.**

Not applicable.

(d) In relation to a habitat of a threatened species, population or ecological community:

> **(i) the extent to which habitat is likely to be removed or modified as a result of the action proposed, and**
>
> **(ii) whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the Proposal, and**
>
> **(iii) the importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species, population or ecological community in the locality.**

The proposed actions would require the extension of existing culverts and removal of vegetation. The extension of culverts would increase potential roosting habitat for this species.

The actions proposed are likely to result in a limited amount of microbat habitat to be removed or modified.

This species is capable of dispersing large distances up to 300 kms from maternity caves.

Given this species is highly mobile and only a small amount of potential habitat is to be removed/modified, it is unlikely the microbat habitat within the Proposal Boundary would become fragmented or isolated as a result of the Proposal.

Given the relatively small amount of habitat to be removed as a result of the Proposal and the currently fragmented nature of much of the Proposal Boundary, it is unlikely that any habitat to be removed is important to the long-term survival of any of these species.

It is unlikely that the habitat to be modified or removed is important to the long term survival of these species.

(e) Whether the action proposed is likely to have an adverse effect on critical habitat (either directly or indirectly).

To date, no critical habitat has been declared under the TSC Act for this species.

Not applicable.

(f) Whether the action proposed is consistent with the objectives or actions of a recovery plan or threat abatement plan.

This species has been assigned to the site-managed species management stream under the Saving our Species program. As such four management sites have been proposed throughout the species' range in order to encourage its recovery. The nearest of these sites to the Proposal is over 160 km away.

Management strategies to protect this species include habitat protection and maintenance, introduced domestic and feral animal control programs and the maintenance and enhancement of floristic and structural diversity of vegetation through the alteration of prescribed burning and grazing regimes.

The Proposal does not conflict with the recovery objectives listed for this species.

(g) Whether the action proposed constitutes or is part of a key threatening process or is likely to result in the operation of, or increase the impact of, a key threatening process.

The clearing of native vegetation is listed as a key threatening process under the TSC Act. The Proposal has the potential to adversely affect Eastern Bentwing Bats through the loss of foraging resources and potential breeding habitat. However, vegetation clearing is unlikely to impact important habitat for this species and a range of mitigation measures have been proposed including the retention of all remnant vegetation where possible and the minimising of off-site indirect impacts e.g. stormwater impacts.

The Proposal would result in a minor increase in the impact of a key threatening process.

Conclusion

There is limited suitable foraging and roosting habitat within the Proposal Boundary for this species. While the proposed works are likely to affect some potential foraging habitat, the limited area of disturbance and proposed mitigation strategies suggest any potential actions are unlikely to significantly affect these species.

A Species Impact Statement is not required.

References

OEH 2015 Eastern Bentwing Bat Threatened Species Profile. Accessed 21st August 2015 http://www.environment.nsw.gov.au/threatenedspeciesapp/profile.aspx?id=10534

Glossy Black-cockatoo (*Calyptorhynchus lathami*), (Little Lorikeet *Glossopsitta pusilla*) and Gang-gang Cockatoo (*Callocephalon fimbriatum*)

(a) In the case of a threatened species, whether the action proposed is likely to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction.

Glossy black-cockatoo, Little Lorikeet and Gang-gang Cockatoo are listed as Vulnerable under the TSC Act. These species are dependent on mature vegetation for nesting and roosting, with particular requirement for hollows for nesting.

Hollow bearing trees are present within the Proposal Boundary but are not abundant. While there would be some removal of vegetation adjacent to the existing alignment of the M1 Pacific Motorway all large remnant trees would be retained at all ancillary sites. As such the impact upon breeding habitat for these species is likely to be limited to disturbance from site vehicles and activities. It is unlikely that these actions would have an adverse effect on these species such that any potential viable local population would be placed at risk of extinction.

(b) In the case of an endangered population, whether the action proposed is likely to have an adverse effect on the life cycle of the species that constitutes the endangered population such that a viable local population of the species is likely to be placed at risk of extinction.

Not applicable.

(c) In the case of an endangered ecological community or critically endangered ecological community, whether the action proposed:

> **(i) is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction, or**
>
> **(ii) is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction.**

Not applicable.

(d) In relation to a habitat of a threatened species, population or ecological community:

> **(i) the extent to which habitat is likely to be removed or modified as a result of the action proposed, and**
>
> **(ii) whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the Proposal, and**
>
> **(iii) the importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species, population or ecological community in the locality.**

The Proposal Boundary only provides limited foraging, roosting and nesting opportunities for these species. The Proposal Boundary contains numerous hollow bearing trees, and some of these would be removed as part of the works.

A limited amount of woodland bird habitat would potentially be removed or modified by the proposed actions.

The clearing of vegetation for the widening of the existing M1 Pacific Motorway and the establishment of ancillary sites would involve the clearing of vegetation. The limited overall

extent of these works however means that habitat for these species is unlikely to be significantly fragmented or isolated.

It is unlikely that woodland bird habitat would become fragmented or isolated as a result of the proposed actions.

Based upon the generally disturbed nature of the Proposal Boundary and presence of the existing M1 Pacific Motorway the area is not likely to be habitat important to the long-term survival of these species.

The habitat to be removed in unlikely to be important to the long-term survival of these species.

(e) Whether the action proposed is likely to have an adverse effect on critical habitat (either directly or indirectly).

To date, no critical habitat has been declared under the TSC Act for this species.

Not applicable.

(f) Whether the action proposed is consistent with the objectives or actions of a recovery plan or threat abatement plan.

Site management activities have been proposed for both the Glossy Black Cockatoo and the Little Lorikeet under the Saving Our Species program. Recovery objectives these species are primarily concerned with the protection of breeding habitat, identifying non- breeding habitat and ecological research. The Gang-gang Cockatoo has been assigned the Landscape species management stream under the Saving Our Species program. Threats to the viability of landscape-managed species are loss, fragmentation and degradation of habitat, and widespread pervasive factors such as impacts of climate change and disease.

The Proposal would remove a very small amount of potential breeding habitat for these species in the form of tree hollows.

(g) Whether the action proposed constitutes or is part of a key threatening process or is likely to result in the operation of, or increase the impact of, a key threatening process.

The clearing of native vegetation and loss of hollow-bearing trees are listed as a key threatening processes under the TSC Act. This has the potential to adversely affect threatened woodland bird species through the loss of feeding sites and potential nesting habitat. However, vegetation clearing is unlikely to affect important habitat for these species.

The proposed actions are likely to result in a minor increase in the impact of key threatening processes.

Conclusion

Given these species are highly mobile and the Proposal Boundary only provides limited foraging, roosting and nesting opportunities it is unlikely the Proposal would have negative impact upon them. As a small amount of habitat would be removed by the Proposal mitigation strategies have been proposed to retain these habitat features where possible.

A Species Impact Statement is not required.

References

OEH 2015 Glossy Black-cockatoo Threatened Species Profile. Accessed 21st August 2015 http://www.environment.nsw.gov.au/threatenedspeciesapp/profile.aspx?id=10140

OEH 2015 Little Lorikeet Threatened Species Profile. Accessed 21st August 2015 http://www.environment.nsw.gov.au/threatenedSpeciesApp/profile.aspx?id=20111

OEH 2015 Gang-gang Cockatoo Threatened Species Profile. Accessed 6th October 2015 http://www.environment.nsw.gov.au/threatenedSpeciesApp/profile.aspx?id=10975

Swift Parrot (*Lathamus discolor*) and Regent Honeyeater (*Anthochaera phrygia*)

The Swift Parrot is listed as endangered under the TSC Act. The Regent Honeyeater listed as critically endangered under the TSC Act.

(a) In the case of a threatened species, whether the action proposed is likely to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction.

These species move extensively in response to food availability within the landscape, returning to localised areas to breed over spring and summer. The Swift Parrot nests exclusively in Tasmania and no breeding habitat would be impacted for this species. Similarly the Regent Honeyeater returns to specific breeding locations, the closest of these to the Proposal Boundary occur north of Newcastle.

Both the Swift Parrot and Regent Honeyeater do not have breeding habitat within the Proposal Boundary.

The foraging habitat to be removed is unlikely to significantly affect the life cycle of either species such that a local population would be at risk of extinction.

(b) In the case of an endangered population, whether the action proposed is likely to have an adverse effect on the life cycle of the species that constitutes the endangered population such that a viable local population of the species is likely to be placed at risk of extinction.

Not applicable.

(c) In the case of an endangered ecological community or critically endangered ecological community, whether the action proposed:

> **(i) is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction, or**
>
> **(ii) is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction.**

Not applicable.

(d) In relation to a habitat of a threatened species, population or ecological community:

> **(i) the extent to which habitat is likely to be removed or modified as a result of the action proposed, and**
>
> **(ii) whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the Proposal, and**
>
> **(iii) the importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species, population or ecological community in the locality.**

The Proposal Boundary only provides limited foraging, roosting and nesting opportunities for these species.

A limited amount of woodland bird habitat would potentially be removed or modified by the proposed actions.

The clearing of vegetation for the widening of the existing M1 Pacific Motorway and the establishment of ancillary sites would involve the clearing of vegetation. The limited overall extent of these works however means that habitat for these species is unlikely to be significantly fragmented or isolated.

It is unlikely that woodland bird habitat would become fragmented or isolated as a result of the proposed actions.

Based upon the generally disturbed nature of the Proposal Boundary and presence of the existing M1 Pacific Motorway the area is not likely to be habitat important to the long-term survival of these species.

(e) Whether the action proposed is likely to have an adverse effect on critical habitat (either directly or indirectly).

To date, no critical habitat has been declared under the TSC Act for this species.

Not applicable.

(f) Whether the action proposed is consistent with the objectives or actions of a recovery plan or threat abatement plan.

A national recovery plan has been developed for the Swift Parrot (Birds Australia, 2011). A national recovery plan has been developed for the Regent Honeyeater (National Heritage Trust, 1999). Recovery objectives for this species are primarily concerned with the protection of breeding habitat, identifying non-breeding habitat and ecological research into the species.

The Proposal would remove a very small amount of potential breeding habitat for these species in the form of mature vegetation. Mitigation measures are in place to retain this all mature vegetation wherever possible.

(g) Whether the action proposed constitutes or is part of a key threatening process or is likely to result in the operation of, or increase the impact of, a key threatening process.

The clearing of native vegetation is listed as a key threatening process under the TSC Act. This has the potential to adversely affect threatened woodland bird species through the loss of feeding sites. However, vegetation clearing is unlikely to affect important habitat for these species and a range of mitigation measures have been proposed including the retention of mature remnant vegetation.

The proposed actions are likely to result in a minor increase in the impact of a key threatening process.

Conclusion

Given these species are highly mobile and the Proposal Boundary only provides limited foraging and roosting opportunities it is unlikely the Proposal would have negative impact upon them. As a small amount of habitat would be removed by the Proposal mitigation strategies have been proposed to retain these habitat features where possible.

A Species Impact Statement is not required.

References

Birdlife Australia 2011 Swift Parrot National Recovery Plan. Accessed 31st August http://www.environment.gov.au/system/files/resources/c3e20a20-8122-4a9c-bd06-455ea7620380/files/lathamus-discolor-swift-parrot.pdf

National Heritage Trust 2009 National Recovery Plan for the Regent Honeyeater. Accessed 31st August http://www.environment.gov.au/system/files/resources/91aed8af-670d-4f56-9ef8-20bd4141ac76/files/regent-h-eater.pdf

OEH 2015 Swift Parrot Threatened Species Profile. Accessed 31st August 2015 http://www.environment.nsw.gov.au/threatenedspeciesapp/profile.aspx?id=10455

OEH 2015 Regent Honeyeater Threatened Species Profile. Accessed 31st August 2015 http://www.environment.nsw.gov.au/threatenedSpeciesApp/profile.aspx?id=10841

DoE 2015 Swift Parrot SPRAT Profile. Accessed 31st August 2015 http://www.environment.gov.au/cgi-bin/sprat/public/publicspecies.pl?taxon_id=744

DoE 2015 Regent Honeyeater SPRAT Profile. Accessed 31st August 2015 http://www.environment.gov.au/cgi-bin/sprat/public/publicspecies.pl?taxon_id=82338

Powerful Owl (*Ninox strenua*), Masked Owl (*Tyto novaehollandiae*) and Barking Owl (*Ninox connivens*)

The Powerful Owl, Barking Owl and Masked Owl are listed as Vulnerable under the TSC Act.

(a) In the case of a threatened species, whether the action proposed is likely to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction.

Powerful Owl, Barking Owl and Masked Owl are both listed as Vulnerable under the TSC Act. Both species require large tracts of forest for foraging that are suitable to sustain prey populations of small mammals. These Owls require hollows in large mature trees for shelter, breeding and nesting.

Given the site does not consist of contiguous forest capable of maintain a large mammal population and has limited mature hollow bearing trees, it is unlikely the Proposal would have an adverse effect on the life cycle of these four species to the extent that they would be placed at risk of extinction.

(b) In the case of an endangered population, whether the action proposed is likely to have an adverse effect on the life cycle of the species that constitutes the endangered population such that a viable local population of the species is likely to be placed at risk of extinction.

Not applicable.

(c) In the case of an endangered ecological community or critically endangered ecological community, whether the action proposed:

> **(i) is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction, or**
>
> **(ii) is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction.**

Not applicable.

(d) In relation to a habitat of a threatened species, population or ecological community:

> **(i) the extent to which habitat is likely to be removed or modified as a result of the action proposed, and**
>
> **(ii) whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the Proposal, and**
>
> **(iii) the importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species, population or ecological community in the locality.**

The Proposal Boundary provides limited roosting, breeding and nesting habitat. The Powerful Owl requires large trees between 80-240 cm diameter at breast height, which are only present in restricted sections of the Proposal Boundary. The Proposal Boundary may provide some foraging habitat, with evidence of small mammals within the Proposal Boundary.

The Proposal Boundary is unsuitable to meet the habitat requirement of these Owl species. A very limited amount of Owl habitat would be removed or modified as a result of the Proposal.

The habitat to potentially be removed is surrounded by remnant vegetation of varied quality. These species are highly mobile, with home ranges between 400-1450 ha for the Powerful Owl, 2000-6000 ha for the Barking Owl and 500-1000 ha for the Masked Owl.

Given the mobility of these species, their large home ranges and the limited suitability of the study site, it is highly unlikely that the Proposal would result in the fragmentation or isolation of Owl habitat.

There are limited mature trees with hollows large enough to provide nesting habitat for these Owl species. Hollow bearing trees and remnant vegetation are to be retained where possible.

Vegetation that would be removed is unlikely to include suitable Owl habitat and therefore unimportant to the long-term survival of any Powerful Owl, Barking Owl or Masked Owl populations that may occur within the Proposal Boundary.

(e) Whether the action proposed is likely to have an adverse effect on critical habitat (either directly or indirectly).

To date, no critical habitat has been declared under the TSC Act for this species.

Not applicable.

(f) Whether the action proposed is consistent with the objectives or actions of a recovery plan or threat abatement plan.

A NSW Recovery Plan has been developed for the Large Forest Owls (DEC, 2006). Specific recovery objectives and actions that are relevant to the proposed activity include:

- minimising further loss and fragmentation of habitat outside conservation reserves and State Forests by protection and management of significant Owl habitat (including protection of individual nest sites); and
- minimising the impacts of development activities on large forest Owls and their habitats outside conservation reserves and State Forests.

The proposed action is consistent with these objectives and actions, as habitat loss and fragmentation associated with the activity would be constrained to areas considered to be of low importance to the long-term survival of the three Owl species, and thus does not constitute significant habitat.

(g) Whether the action proposed constitutes or is part of a key threatening process or is likely to result in the operation of, or increase the impact of, a key threatening process.

The clearing of native vegetation is listed as a key threatening process under the TSC Act. This has the potential to adversely affect Owl species through the loss of foraging resources and potential nesting habitat. However, vegetation clearing is unlikely to impact important habitat for these species and a range of mitigation measures have been proposed including the retention of hollow bearing trees and remnant vegetation.

The Proposal is likely to result in a minor increase in the impact of a key threatening process.

Conclusion

Given these species high mobility, the retention of hollow bearing trees and remnant vegetation, the Proposal is unlikely to significantly impact either the Powerful Owl, Barking Owl or Masked Owl.

A Species Impact Statement is not required.

References

DEC 2006 NSW Recovery Plan for the Large Forest Owls. Accessed 31st August 2015 http://www.environment.nsw.gov.au/resources/nature/TSRecoveryPlanForestOwls.pdf

OEH 2015 Masked Owl Threatened Species Profile. Accessed 21st August 2015 http://www.environment.nsw.gov.au/threatenedSpeciesApp/profile.aspx?id=10820

OEH 2015 Powerful Owl Threatened Species Profile. Accessed 21st August 2015 http://www.environment.nsw.gov.au/threatenedspeciesapp/profile.aspx?id=10562

OEH 2015 Barking Owl Threatened Species Profile. Accessed 6th October 2015 http://www.environment.nsw.gov.au/threatenedspeciesapp/profile.aspx?id=10561

Long-nosed Potoroo (*Potorous tridactylus tridactylus*), Eastern Chestnut Mouse (*Pseudomys gracilicaudatus*), Eastern Pygmy Possum (*Cercartetus nanus*) and Southern Brown Bandicoot (*Isoodon obesulus*)

(a) In the case of a threatened species, whether the action proposed is likely to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction.

The Long-nosed Potoroo is listed as Vulnerable under the TSC Act. This species requires a dense understorey with occasional open patches amongst coastal heaths and dry and wet sclerophyll forests. Underground-fruiting fungi are an important part of their diet and they often dig small holes in a similar manner to bandicoots.

The Eastern Chestnut Mouse is found in dense, wet heath and swamps. Heath regenerating from fire is most preferred. It forages amongst grasses and sedges for grass stems, invertebrates, fungi and seeds.

The Eastern Pygmy Possum inhabits woodlands and heath, occasionally rainforest where it forages for nectar and pollen of banksias, eucalypts and bottlebrushes. It shelters in tree hollows, rotten stumps, holes in the ground or abandoned bird-nests.

The Southern Brown Bandicoot is found in heath or open forest with a heathy understorey on sandy or friable soils. It nests in a shallow depression in the ground covered by vegetation. It searches for insects or underground-fruiting fungi by digging conical holes in the soil.

The Proposal would result in the removal of open forest, heath and swamp habitats that these species inhabit. The habitat to be removed is fragmented and subject to a high level of disturbance, largely adjacent to the M1 Pacific Motorway. These habitats are unlikely to be used for breeding.

As such it is unlikely that the Proposal would have an adverse effect on the life cycle of the four species such that a viable local population of any of the species is likely to be placed at risk of extinction.

(b) In the case of an endangered population, whether the action proposed is likely to have an adverse effect on the life cycle of the species that constitutes the endangered population such that a viable local population of the species is likely to be placed at risk of extinction.

Not applicable.

(c) In the case of an endangered ecological community or critically endangered ecological community, whether the action proposed:

> **(i) is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction, or**
>
> **(ii) is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction.**

Not applicable.

(d) In relation to a habitat of a threatened species, population or ecological community:

(i) the extent to which habitat is likely to be removed or modified as a result of the action proposed, and

(ii) whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the Proposal, and

(iii) the importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species, population or ecological community in the locality.

The Proposal would result in the removal of 22.88 ha of open forest habitat and 1.49 ha of swamp forest habitat. Swamp forest would provide habitat for the Eastern Chestnut Mouse and open forest would provide habitat for the other three mammals.

The linear nature of the proposed widening would not isolate or fragment any remaining habitat after the clearing has been undertaken.

No habitat is likely to become fragmented or isolated as a result of the Proposal.

Much of the area proposed for clearing as part of the Proposal is of a degraded and sub-optimal state for the four threatened mammals. Of the pockets that may be suitable it is considered highly unlikely that these constitute important habitat to the extent that its removal would threaten the long-term survival of the species.

The habitat to be removed/modified is not likely to be of importance to the long-term survival of these species.

(e) Whether the action proposed is likely to have an adverse effect on critical habitat (either directly or indirectly).

To date, no critical habitat has been declared under the TSC Act for this species.

Not applicable.

(f) Whether the action proposed is consistent with the objectives or actions of a recovery plan or threat abatement plan.

This Long-nosed Potoroo, Eastern Chestnut Mouse and Southern Brown Bandicoot have been assigned to the site-managed species management stream under the Saving our Species program. As such management sites have been set up throughout the species' range in order to encourage its recovery. None of the management sites are at, or in close proximity to, the Proposal.

The Eastern Pygmy Possum has been assigned to the Landscape management stream. Threatened species in this management stream are distributed across large areas, or are highly mobile and threatened across the landscape by habitat loss and degradation. They are managed using measures such as broad-scale vegetation and habitat management programs, land clearing controls, water management plans and management of national parks and reserves.

The Proposal does not conflict with the management strategies listed for this species.

(g) Whether the action proposed constitutes or is part of a key threatening process or is likely to result in the operation of, or increase the impact of, a key threatening process.

The clearing of native vegetation is listed as a key threatening process under the TSC Act. The Proposal has the potential to adversely affect Long-nosed Potoroos, Eastern Chestnut Mouse, Eastern Pygmy Possum and Southern Brown Bandicoot through the loss of foraging resources and potential breeding habitat.

The loss of hollow-bearing trees and loss of dead wood are listed as a key threatening process under the TSC Act. These processes have the potential to impact the Eastern Pygmy Possum. The Proposal would result in the loss of hollow-bearing trees and the removal of dead wood, including hollow logs.

The Proposal is unlikely to significantly increase the impact of a key threatening process.

Conclusion

Given the existing range of the four species and the highly fragmented and disturbed nature of the habitats to be impacted, the Proposal would not have a significant impact on the Long-nosed Potoroo, Eastern Chestnut Mouse, Eastern Pygmy Possum or Souothenr Brown Bandicoot.

A Species Impact Statement is not required.

References

OEH 2015 Long-nosed Potoroo Threatened Species Profile. Accessed 21st August 2015 http://www.environment.nsw.gov.au/threatenedspeciesapp/profile.aspx?id=10662

Koala (*Phascolarctos cinereus*)

(a) In the case of a threatened species, whether the action proposed is likely to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction.

A desktop assessment of Wildlife Atlas records showed that Koalas had been recorded only seven times within a 10 km area containing the study since 1916, with the most recent of these records being 2003 and 2007. As there have been no recent records in the area it was determined that the Proposal Boundary was not likely to support a viable resident population. During the Koala habitat survey no individuals, or characteristic scratching or scats, were identified. Despite having potential to occur, there is no evidence to suggest a viable resident Koala population exists within the Proposal Boundary.

The actions planned are unlikely to have a negative impact on the life cycle of any viable local population potentially occurring within the Proposal Boundary to the extent that it would be placed at risk of extinction.

(b) In the case of an endangered population, whether the action proposed is likely to have an adverse effect on the life cycle of the species that constitutes the endangered population such that a viable local population of the species is likely to be placed at risk of extinction.

Not applicable.

(c) In the case of an endangered ecological community or critically endangered ecological community, whether the action proposed:

> **(i) is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction, or**
>
> **(ii) is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction.**

Not applicable.

(d) In relation to a habitat of a threatened species, population or ecological community:

> **(i) the extent to which habitat is likely to be removed or modified as a result of the action proposed, and**
>
> **(ii) whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the Proposal, and**
>
> **(iii) the importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species, population or ecological community in the locality.**

The original Project REF assessed the impact to potential Koala habitat within the Proposal Boundary. No clearing of Koala habitat was proposed.

The Proposal would involve clearing of 0.27 ha of potential Koala habitat within the Proposal Boundary.

The majority of clearing proposed would occur adjacent to the M1 Pacific Motorway, roadside or cleared land in areas subject to fragmentation. Koalas are capable of moving large distances in search of food, with home ranges between two and several hundred ha.

It is unlikely that Koala habitat would become further fragmented or isolated as a result of the proposed action.

The assessment indicated that few areas had the potential to provide Koala habitat within the Proposal Boundary due to the presence of greater than 15% cover of recognised food tree species. Given that remnant eucalyptus species are recommended to be retained throughout most of the Proposal Boundary it is not expected that any habitat important to the long term survival of the species would be affected.

(e) Whether the action proposed is likely to have an adverse effect on critical habitat (either directly or indirectly).

To date, no critical habitat has been declared under the TSC Act for this species.

Not applicable.

(f) Whether the action proposed is consistent with the objectives or actions of a recovery plan or threat abatement plan.

A recovery plan has been developed for the Koala (DECC, 2008) and includes an overall objectives to 'reverse the decline of the Koala in New South Wales, to ensure adequate protection, management and restoration of Koala habitat, and to maintain healthy breeding populations of Koalas throughout their current range'.

As there is no breeding population of Koalas on site and core habitat would not be disturbed the actions proposed would not interfere with the objectives of the recovery plan.

(g) Whether the action proposed constitutes or is part of a key threatening process or is likely to result in the operation of, or increase the impact of, a key threatening process.

The proposed works constitutes part of the key threatening process of 'clearing native vegetation', due to some vegetation occurring within the area of direct impact. However, potential Koala habitat and important remnant vegetation is to be retained.

While a small amount of potential habitat would be cleared, mitigation measures recommend the retention of remnant eucalyptus species in areas of potential Koala habitat. Therefore it is unlikely that the actions proposed would significantly increase the impact of a key threatening process.

Conclusion

The proposed development is not considered to have a negative impact upon the Koala. This is due to the low value of the potential habitat to be cleared generally and the commitment to retain remnant eucalyptus species within areas of potential Koala habitat.

A Species Impact Statement is not required.

References

DECC 2008 National Recovery Plan for the Koala. Accessed 31st August 2015. http://www.environment.nsw.gov.au/resources/threatenedspecies/08450krp.pdf

OEH 2015 Koala Threatened Species Profile. Accessed 21st August 2015 http://www.environment.nsw.gov.au/threatenedspeciesapp/profile.aspx?id=10616

Grey-headed flying-fox (*Pteropus poliocephalus*)

(a) In the case of a threatened species, whether the action proposed is likely to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction.

The Grey-headed flying-fox is listed as Vulnerable under the TSC Act. Roosting sites are located in the branches of large trees in rainforest patches, Melaleuca stands, mangroves, riparian woodland or modified vegetation in urban areas. No camps are present on site or in the immediate surrounds

The Proposal is unlikely to have an adverse effect on the life cycle of the species such that any potential viable population would be placed at risk of extinction.

(b) In the case of an endangered population, whether the action proposed is likely to have an adverse effect on the life cycle of the species that constitutes the endangered population such that a viable local population of the species is likely to be placed at risk of extinction.

Not applicable.

(c) In the case of an endangered ecological community or critically endangered ecological community, whether the action proposed:

(i) is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction, or

(ii) is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction.

Not applicable.

(d) In relation to a habitat of a threatened species, population or ecological community:

(i) the extent to which habitat is likely to be removed or modified as a result of the action proposed, and

(ii) whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the Proposal, and

(iii) the importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species, population or ecological community in the locality.

Some foraging habitat would be removed by the Proposal, but would mainly be limited to disjunct areas of disturbed habitat.

As there are no roosts within the Proposal Boundary and only minimal impacts on foraging habitat, only a small amount of Grey-headed Flying-fox habitat would be removed or modified as a result of the proposed actions.

The Grey-headed flying-fox is highly mobile, capable of foraging movements of up to 50 kms from permanent camps.

It is highly unlikely that any potential flying fox habitat would become fragmented or isolated as a result of the Proposal.

The habitat to be removed is primarily in the median strip and adjacent to the roadside.

The vegetation to be removed is of low quality habitat for the Grey-headed Flying-fox, with most of the areas to be modified dominated by invasive grass species previous land clearing.

The habitat to be removed/modified as a result of the proposed areas is likely to have little importance to the long-term survival of this species.

(e) Whether the action proposed is likely to have an adverse effect on critical habitat (either directly or indirectly).

To date, no critical habitat has been declared under the TSC Act for this species.

Not applicable.

(f) Whether the action proposed is consistent with the objectives or actions of a recovery plan or threat abatement plan.

A draft recovery plan for the Grey-headed Flying-fox has been prepared (DECCW, 2009). Its overall objectives are to reduce the impact of threatening processes and conserve the functional role of the Grey-headed flying-fox in seed dispersal and pollination, by protecting foraging and roosting habitat.

As the Proposal includes mitigation measures to retain remnant habitat, the actions are unlikely to adversely affect recovery strategies.

(g) Whether the action proposed constitutes or is part of a key threatening process or is likely to result in the operation of, or increase the impact of, a key threatening process.

The proposed works constitutes part of the key threatening process of 'clearing native vegetation', due to some vegetation occurring within the area of direct impact. However, remnant vegetation is to be retained.

While a small amount of potential habitat would be cleared, mitigation measures recommend the retention of mature vegetation where possible. Therefore it is unlikely that the actions proposed would significantly increase the impact of a key threatening process.

Conclusion

Within the areas of impact there is very little suitable foraging or roosting habitat for the Grey-headed Flying- fox. While the proposed work is likely to affect some potential foraging habitat, the small area of disturbance and high mobility of this species means it is unlikely that there would be a significant impact to the Grey-headed Flying Fox.

A Species Impact Statement is not required.

References

OEH 2015 Grey-headed Flying Fox Threatened Species Profile. Accessed 21st August 2015 http://www.environment.nsw.gov.au/threatenedspeciesapp/profile.aspx?id=10697

DECCW 2009 Draft national recovery plan for the Grey-headed Flying Fox. Accessed 31st August 2015 http://www.environment.nsw.gov.au/resources/threatenedspecies/08214dnrpflyingfox.pdf

Little Eagle (*Hieraaetus morphnoides*) and Square-tailed Kite (*Lophoincuta isura*)

Little Eagle (*Hieraaetus morphnoides*) is listed as Vulnerable under the TSC Act. The Little Eagle is found in most of mainland Australia, occurring as a single population in NSW (NSW Scientific Committee 2011). It inhabits open eucalypt forest, woodland or open woodland including she-oak and acacia woodlands and riparian woodland.

Several records of Little Eagle occur within 10 km of the Proposal Boundary, the most recent dating form 2006 near Jilliby. Two potential Little Eagle nests were identified within the Proposal Boundary. The first was found between the northbound off ramp of the Doyalson Link Road and the M1 in Wallarah, NSW. The nest is located in an *Angophora costata* (Smooth-barked Apple) that is proposed to be cleared for the Tuggerah to Doyalson upgrade of the Pacific Motorway (M1) (the Proposal). It was confirmed as a Little Eagle nest by John 'Young (pers. comm).

Prior to the commencement of construction activities, it is proposed to remove the tree within the Tuggerah to Doyalson impact footprint containing the Little Eagle nest (the Proposal) in order for this to occur outside of the breeding season of the Little Eagle.

The second is located approximately one km away, west of the M1 Pacific Motorway on ancillary site W9. This tree and nest would be retained and activities at the ancillary site would be established prior to the commencement of the breeding season for the Little Eagle. This nest has not been confirmed as a Little Eagle nest by an expert, though it displays characteristics of the species' nests.

The Square-tailed Kite is listed as Vulnerable under the TSC Act. The species is found in a variety of timbered habitats including dry woodlands and pen forests. It shows a particular preference for timbered watercourses. It is a specialist hunter of passerines, especially honeyeaters, and most particularly nestlings, and insects in the tree canopy, picking most prey items from the outer foliage. It appears to occupy large hunting ranges of more than 100km2.

(a) In the case of a threatened species, whether the action proposed is likely to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction.

Little Eagles select tall living trees for nest sites. Nests are either newly built or existing stick nests are reused. The nests are about 800 mm in diameter and lined daily with fresh leaves (Schodde & Tidemann 1986). Nests may be used repeatedly and a number of nests may be used in rotation over several years, or new ones constructed (Simpson & Day 1996). Eggs are laid in August or early spring, incubated for 30-35 days and young fledge about 50 days later, usually late summer.

A single Little Eagle nest would be removed for the Proposal. A second potential nest is located on an ancillary site. This nest tree would remain in situ and not be cleared. The activities proposed at the ancillary site include concrete reprocessing, asphalt batching, site compounds, stockpiling equipment storage and daily vehicle movements. These activities are likely to indirectly impact the Little Eagle if a pair is actively nesting at the time of construction.

The Proposal would therefore impact a local breeding pair and the life cycle of the species. The nest proposed for removal prior to the start of the breeding season in 2015 to minimise impacts to breeding and enable the breeding pair to find another suitable nest, if necessary. Similarly establishment of the ancillary site should be completed by June or July prior to the breeding season commencing. It is possible that additional nests are present in the area which would support the breeding pair for the next nesting season. The pair may also build another nest, at least by the following breeding season.

Little Eagles are territorial and a single breeding pair is expected to occupy the Proposal Boundary and locality. There is potential that the removal of the nest may reduce breeding success for the pair in the coming breeding season, however breeding success beyond this season is unlikely to be affected by the nest removal. The local population may be at risk of decline if successive breeding seasons fail. The Proposal includes measures such as retaining the second nest in situ and timing the commencement of works so as not to disrupt nesting attempts. As such, the local population is unlikely to be placed at risk of extinction as a result of the Proposal.

The Square-tailed Kite breeds from July to February. It nests along or near watercourses in a fork or on large horizontal limbs. No raptor nests have been identified along any of the watercourses that pass through the Proposal Boundary. It is unlikely that the species is breeding in vegetation to be impacted by the Proposal. As such, it is unlikely that the species life cycle would be impacted such that a local population is laced at risk of extinction.

(b) In the case of an endangered population, whether the action proposed is likely to have an adverse effect on the life cycle of the species that constitutes the endangered population such that a viable local population of the species is likely to be placed at risk of extinction.

Not applicable.

(c) In the case of an endangered ecological community or critically endangered ecological community, whether the action proposed:

> **(i) is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction, or**
>
> **(ii) is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction.**

Not applicable.

(d) In relation to a habitat of a threatened species, population or ecological community:

> **(i) the extent to which habitat is likely to be removed or modified as a result of the action proposed, and**
>
> **(ii) whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the Proposal, and**
>
> **(iii) the importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species, population or ecological community in the locality.**

The Proposal would require the removal of a single Little Eagle nest and nest tree.

The nest tree is located within a patch of woodland subject to existing fragmentation from the motorway and off ramp. Vegetation in the broader landscape is fragmented from land clearing and road and residential development. The nest tree and adjoining habitat would be further fragmented as a result of the Proposal, though not specifically as a result of nest tree removal.

These nests are likely to be important to the breeding success of the Little Eagle local population and as such, the long-term survival of the species. Impacts to these nests would be restricted to outside the breeding season to avoid disruption to breeding activities and potential nesting failure. There may also be additional nests in the area used by the same breeding pair that would supplement or safeguard the nest proposed for removal and provide alternate resources to the nest that would be disturbed by the proximity of construction activities. There is

ample vegetation in the broader landscape that would provide opportunities for nest replacement.

The Proposal would also result in the removal of potential foraging habitat for the Little Eagle and Square-tailed Kite. Approximately 22.88 ha of open forest habitat would be removed which represents potential foraging habitat for the two species. Most of the vegetation to be removed is adjacent to the M1 Pacific Motorway and therefore subject to high levels of disturbance. It is unlikely to be of particular importance to either species. The Proposal would not isolate habitat or lead to a notably larger fragmentation of habitat in the landscape.

(e) Whether the action proposed is likely to have an adverse effect on critical habitat (either directly or indirectly).

Under the TSC Act, the Director-General maintains a Register of Critical Habitat. To date, no critical habitat has been declared for the Little Eagle or Square-tailed Kite.

(f) Whether the action proposed is consistent with the objectives or actions of a recovery plan or threat abatement plan.

There is currently no Recovery Plan in place for the Little Eagle or Square-tailed Kite. Both species have been assigned to the Landscape species management stream under the NSW OEH *Saving Our Species* program. Threatened species in this management stream are distributed across large areas, or are highly mobile and threatened across the landscape by habitat loss and degradation. They are managed using measures such as broad-scale vegetation and habitat management programs, land clearing controls, water management plans and management of national parks and reserves.

Three specific management actions are identified for Little Eagle and five for the Square-tailed Kite. The Proposal does not impede the implementation of these management actions.

(g) Whether the action proposed constitutes or is part of a key threatening process or is likely to result in the operation of, or increase the impact of, a key threatening process.

One key threatening process (KTP) is referred to in the Final Determination for Little Eagle as a threat to this species, namely ‘Clearing of native vegetation’. The original Project REF assessed the removal of vegetation within the Proposal Boundary.

The Proposal would require additional clearing as part of the design amendments including clearing of mature trees on ancillary sites. A potential Little Eagle nest tree occurs on an ancillary site. This nest tree would be retained and would not be cleared.

Conclusion

The Proposal would require the removal of a single Little Eagle nest and the likely disturbance to a second potential nest through the increased activities proposed at the ancillary site. The removal of the nest and disturbance to the second nest site could impact the breeding success of the species for the 2015 / 2016 breeding season. There may be additional nests in the area used by the same breeding pair that would supplement or safeguard the nest proposed for removal. Further, there is ample vegetation in the broader landscape that would provide opportunities for nest replacement. As a result, it is considered unlikely that the Proposal represents a significant impact to this Vulnerable species. The Proposal would result in the removal of highly disturbed foraging habitat for the Square-tailed Kite. It is unlikely that the removal of this vegetation would have a significant impact on this species. A Species Impact Statement is not required for either species.

References

NSW Scientific Committee (2011) *Little Eagle* Hieraaetus morphnoides *(Gould 1841) - Vulnerable species listing NSW Scientific Committee - final determination.*

Schodde, R. & Tidemann, S. (1997) *Reader's Digest Complete Book of Australian Birds 2nd Edition*. Reader's Digest Sydney.

Simpson, K. & Day, N. (1996) *Field Guide to the Birds of Australia 5th Edition.* Penguin Books Australia.

Brown Treecreeper (*Climacteris picumnus victoriae*), Varied Sittella (*Daphoenositta chrysoptera*), Painted Honeyeater (*Grantiella picta*) and Scarlet Robin (*Petroica boodang*)

The Brown Treecreeper, Varied Sittella, Scarlet Robin and Painted Honeyeater are listed as Vulnerable under the TSC Act. These species are dependent on mature vegetation for nesting and roosting.

(a) In the case of a threatened species, whether the action proposed is likely to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction.

While there would be some removal of vegetation adjacent to the existing alignment of the M1 Pacific Motorway large remnant trees would be retained at ancillary sites. The Brown Treecreeper is dependent on hollows for breeding. Tree hollows would be retained throughout the Proposal Boundary where possible. As such the impact upon breeding habitat for these species is likely to be limited to disturbance from site vehicles and activities. It is unlikely that these actions would have an adverse effect on these species such that any potential viable local population would be placed at risk of extinction.

(b) In the case of an endangered population, whether the action proposed is likely to have an adverse effect on the life cycle of the species that constitutes the endangered population such that a viable local population of the species is likely to be placed at risk of extinction.

Not applicable.

(c) In the case of an endangered ecological community or critically endangered ecological community, whether the action proposed:

> **(i) is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction, or**
>
> **(ii) is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction.**

Not applicable.

(d) In relation to a habitat of a threatened species, population or ecological community:

> **(i) the extent to which habitat is likely to be removed or modified as a result of the action proposed, and**
>
> **(ii) whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the Proposal, and**
>
> **(iii) the importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species, population or ecological community in the locality.**

The Proposal Boundary only provides limited foraging, roosting and nesting opportunities for these species. The Proposal Boundary contains limited large remnant trees and the majority of these would be retained as part of the works.

A limited amount of woodland bird habitat including hollow bearing trees would potentially be removed or modified by the Proposal.

The clearing of vegetation for the widening of the existing M1 Pacific Motorway and the establishment of ancillary sites would involve the clearing of vegetation. The limited overall extent of these works however means that habitat for these species is unlikely to be significantly fragmented or isolated.

It is unlikely that woodland bird habitat would become fragmented or isolated as a result of the proposed actions.

Based upon the generally disturbed nature of the Proposal Boundary and presence of the existing M1 Pacific Motorway the area is not likely to be habitat important to the long-term survival of these species.

(e) Whether the action proposed is likely to have an adverse effect on critical habitat (either directly or indirectly).

To date, no critical habitat has been declared under the TSC Act for these species.

Not applicable.

(f) Whether the action proposed is consistent with the objectives or actions of a recovery plan or threat abatement plan.

There are currently no recovery plans drafted for the Brown Treecreeper, Varied Sittella, Scarlet Robin or Painted Honeyeater. These species have been assigned to the Landscape species management stream under the NSW OEH *Saving Our Species* program. Threatened species in this management stream are distributed across large areas, or are highly mobile and threatened across the landscape by habitat loss and degradation. They are managed using measures such as broad-scale vegetation and habitat management programs, land clearing controls, water management plans and management of national parks and reserves.

The Proposal would remove a very small amount of potential breeding habitat for these species in the form of mature vegetation. Mitigation measures are in place to retain this all mature vegetation wherever possible.

(g) Whether the action proposed constitutes or is part of a key threatening process or is likely to result in the operation of, or increase the impact of, a key threatening process.

The clearing of native vegetation, removal of dead wood and loss of hollow-bearing trees are listed as a key threatening processes under the TSC Act. This has the potential to adversely affect threatened woodland bird species through the loss of feeding sites and potential breeding habitat for the Brown Treecreeper.

The proposed actions are likely to result in a minor increase in the impact of a key threatening process.

Conclusion

Given these species are highly mobile and the Proposal Boundary only provides limited foraging and roosting opportunities it is unlikely the Proposal would have negative impact upon them. As a small amount of habitat would be removed by the Proposal mitigation strategies have been proposed to retain these habitat features where possible.

A Species Impact Statement is not required.

References

OEH 2015 Brown Treecreeper Threatened Species Profile. Accessed 31st August 2015 http://www.environment.nsw.gov.au/threatenedSpeciesApp/profile.aspx?id=10171

OEH 2015 Painted Honeyeater Threatened Species Profile. Accessed 31st August 2015

http://www.environment.nsw.gov.au/threatenedspeciesapp/profile.aspx?id=10357

OEH 2015 Varied Sittella Threatened Species Profile. Accessed 31st August 2015
http://www.environment.nsw.gov.au/threatenedSpeciesApp/profile.aspx?id=20135

Wallum Froglet (*Crinia tinula*)

Wallum Froglet is listed as Vulnerable under the TSC Act. It breeds in permanent acidic swamps, ephemeral pools and drainage ditches. Breeding normally occurs in colder months, but this species is capable of reproducing all year round following rain.

(a) In the case of a threatened species, whether the action proposed is likely to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction.

The original Project REF assessed the removal of 0.07 ha of potential Wallum Froglet habitat would be affected by this Proposal. This is wholly contained with an ancillary site 3a.

The Proposal would not impact additional potential habitat for this species.

The employment of mitigation measures such as no entry zones around water bodies and appropriate sediment management would reduce the likelihood of having any effect upon any resident population. As such it is not expected that the Proposal would have an adverse effect on the life cycle of this species such that a viable local population is likely to be placed at risk of extinction.

Based upon the amount of potential habitat to be removes it is unlikely that the proposed actions would have an adverse effect on the life cycle of Wallum Froglet to the extent that a viable local population would be placed at risk of extinction.

(b) In the case of an endangered population, whether the action proposed is likely to have an adverse effect on the life cycle of the species that constitutes the endangered population such that a viable local population of the species is likely to be placed at risk of extinction.

Not applicable.

(c) In the case of an endangered ecological community or critically endangered ecological community, whether the action proposed:

> **(i) is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction, or**
>
> **(ii) is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction.**

Not applicable.

(d) In relation to a habitat of a threatened species, population or ecological community:

> **(i) the extent to which habitat is likely to be removed or modified as a result of the action proposed, and**
>
> **(ii) whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the Proposal, and**
>
> **(iii) the importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species, population or ecological community in the locality.**

This species is found in a range of habitats, usually associated with acidic swamps on coastal sand plains. During the day they shelter under leaf litter, debris or burrows of other species.

Based upon the incidence of suitable habitat within the Proposal Boundary only 0.07 ha of potential Wallum Froglet habitat would be affected by the Proposal. This is wholly contained

with ancillary site 3a. The employment of mitigation measures such as no entry zones around water bodies and appropriate sediment management would reduce the likelihood of having any effect upon this area.

A negligible amount of potential habitat for this species would be potentially removed or modified as part of this Proposal.

(e) Whether the action proposed is likely to have an adverse effect on critical habitat (either directly or indirectly).

To date, no critical habitat has been declared under the TSC Act for these species.

Not applicable.

(f) Whether the action proposed is consistent with the objectives or actions of a recovery plan or threat abatement plan.

A recovery plan was developed for the Wallum sedge frog and other Wallum dependent species, including the Wallum Froglet (Meyer et al. 2006). Recovery objectives surround the identification and protection of Wallum Frog habitat.

As there is only very limited Wallum Froglet habitat in the Proposal Boundary, and mitigation measures are in place retain the nature of this habitat, the actions proposed are in line with the recovery plan objectives.

(g) Whether the action proposed constitutes or is part of a key threatening process or is likely to result in the operation of, or increase the impact of, a key threatening process.

The clearing of native vegetation is listed as a key threatening process under the TSC Act. This has the potential to adversely affect Wallum Froglet through the loss of breeding sites and potential shelter habitat. However, vegetation clearing is unlikely to affect important habitat for these species and mitigation measures have been proposed, including the retention of remnant vegetation and a buffer around water bodies. Key threatening processes relevant to this species are:

Infection of frogs by amphibian chytrid causing the disease chytridiomycosis Predation by Plague Minnow (*Gambusia holbrooki*)

The water bodies present within ancillary site 3a would be protected through the employment of no entry zones and appropriate sediment management. This would ensure that the risk of the Proposal resulting in the operation of, or increase the impact of, a key threatening process would be minimised.

The proposed actions are unlikely to increase the impact of a key threatening process.

Conclusion

There is very limited suitable potential habitat for this species within the Proposal Boundary. Mitigation measures such as the implementation of no entry zones and appropriate sediment management are likely to reduce the overall risk to this species. As such it is considered unlikely that the proposed action would have a significant impact upon any potential population of Wallum Froglet within the Proposal Boundary.

A Species Impact Statement is not required.

References

OEH 2015 Wallum Froglet Threatened Species Profile. Accessed 31st August 2015 http://www.environment.nsw.gov.au/threatenedspeciesapp/profile.aspx?id=10183

Mayer et al 2006 Wallum Sedge Frog Recovery Plan.

Meyer, E., Hero, J-M., Shoo, L. and Lewis, B. 2006. National recovery plan for the wallum sedgefrog and other wallum-dependent frog species. Department of the Environment and Water Resources, Canberra. Accessed 1st September 2015 http://www.environment.gov.au/system/files/resources/9f40ec86-f7c6-476a-9712-7676a2f43da6/files/wallum-frogs.pdf

Osprey (*Pandion cristatus*)

Osprey is listed as Vulnerable under the TSC Act. This species is found throughout most of Australian coasts however are rare to absent near settled parts of south-eastern Australia.

(a) In the case of a threatened species, whether the action proposed is likely to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction.

This species was not previously assessed under the original Project REF. This species was recorded on 17 occasions within 10 kms of the Proposal Boundary including at Warnervale Interchange during 2008. This species relies on coastal vegetated areas for foraging and nesting hunting along the mouths of tidal rivers, rocky shorelines and reefs. Nests are made high up in dead trees or in dead crowns of live trees, usually within one km of the sea. No potential breeding habitat is known to occur within the Proposal Boundary.

The Proposal would not impact potential breeding habitat for this species. As such it is not expected that the Proposal would have an adverse effect on the life cycle of this species such that a viable local population is likely to be placed at risk of extinction.

(b) In the case of an endangered population, whether the action proposed is likely to have an adverse effect on the life cycle of the species that constitutes the endangered population such that a viable local population of the species is likely to be placed at risk of extinction.

Not applicable.

(c) In the case of an endangered ecological community or critically endangered ecological community, whether the action proposed:

> **(i) is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction, or**
>
> **(ii) is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction.**

Not applicable.

(d) In relation to a habitat of a threatened species, population or ecological community:

> **(i) the extent to which habitat is likely to be removed or modified as a result of the action proposed, and**
>
> **(ii) whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the Proposal, and**
>
> **(iii) the importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species, population or ecological community in the locality.**

This species is found in a range of habitats, usually within proximity to the coast. The Osprey hunts over open water for fish. The Proposal would not remove potential foraging resources for this species.

The Osprey is a highly mobile species and the Proposal would not fragment of isolate potential habitat for this species.

A negligible amount of potential habitat for this species would be potentially removed or modified as part of the Proposal.

(e) Whether the action proposed is likely to have an adverse effect on critical habitat (either directly or indirectly).

To date, no critical habitat has been declared under the TSC Act for these species.

Not applicable.

(f) Whether the action proposed is consistent with the objectives or actions of a recovery plan or threat abatement plan.

There is currently no Recovery Plan in place for the Osprey. The Osprey has been assigned to the Landscape species management stream under the NSW OEH *Saving Our Species* program. Threatened species in this management stream are distributed across large areas, or are highly mobile and threatened across the landscape by habitat loss and degradation. They are managed using measures such as broad-scale vegetation and habitat management programs, land clearing controls, water management plans and management of national parks and reserves.

Three specific management actions are identified for Osprey:

- Identification of nesting sites.
- Communicate the important of maintaining nests during the non-breeding period (December-April).
- Raise awareness of loss of habitat through population pressure and implement appropriate controls in areas subject to urban expansion, including identification of appropriate habitat and implementation of improved management.

The Proposal does not impede the implementation of these management actions.

(g) Whether the action proposed constitutes or is part of a key threatening process or is likely to result in the operation of, or increase the impact of, a key threatening process.

The clearing of native vegetation is listed as a key threatening process under the TSC Act. This has the potential to adversely affect the Osprey through the loss of minor potential habitat. However, vegetation clearing is unlikely to affect important habitat for these species and mitigation measures have been proposed, including the retention of remnant vegetation and a buffer around water bodies, including the riparian vegetation of Wyong River.

Conclusion

There is very limited suitable potential habitat for this species within the Proposal Boundary. Mitigation measures such as the implementation of retention of remnant vegetation is likely to reduce the overall risk to this species. As such it is considered unlikely that the proposed action would have a significant impact upon any potential population of Osprey within the Proposal Boundary.

A Species Impact Statement is not required.

References

OEH 2015 Osprey Threatened Species Profile. Accessed 31st August 2015 http://www.environment.nsw.gov.au/threatenedSpeciesApp/profile.aspx?id=10585

Bush Stone-curlew (*Burhinus grallarius*)

The Bush Stone-curlew is listed as an Endangered species under the TSC Act. The Bush Stone-curlew is found throughout Australia except for the central southern coast and inland, the far south-east corner, and Tasmania. Only in northern Australia is it still common however and in the south-east it is either rare or extinct throughout its former range. It inhabits open forests and woodlands with a sparse grassy groundlayer and fallen timber. It is largely nocturnal, being especially active on moonlit nights. It feeds on insects and small vertebrates, such as frogs, lizards and snakes. It nests on the ground in a scrape or small bare patch. Two eggs are laid in spring and early summer.

(a) In the case of a threatened species, whether the action proposed is likely to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction.

The Proposal would result in the removal of open forest habitat that could be suitable for the Bush Stone-curlew. The habitat to be removed is fragmented and subject to a high level of disturbance, largely adjacent to the M1 Pacific Motorway. This habitat is unlikely to be used for breeding.

As such it is unlikely that the Proposal would have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction.

(b) In the case of an endangered population, whether the action proposed is likely to have an adverse effect on the life cycle of the species that constitutes the endangered population such that a viable local population of the species is likely to be placed at risk of extinction.

Not applicable.

(c) In the case of an endangered ecological community or critically endangered ecological community, whether the action proposed:

> **(i) is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction, or**
>
> **(ii) is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction.**

Not applicable.

(d) In relation to a habitat of a threatened species, population or ecological community:

> **(i) the extent to which habitat is likely to be removed or modified as a result of the action proposed, and**
>
> **(ii) whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the Proposal, and**
>
> **(iii) the importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species, population or ecological community in the locality.**

The Proposal would result in the removal of 22.88 ha of open forest that would provide habitat for the Bush Stone-curlew.

The linear nature of the proposed widening would not isolate or fragment any remaining habitat after the clearing has been undertaken.

Much of the area proposed for clearing as part of the Proposal is of a degraded and sub-optimal state for this species. Of the pockets that may be suitable it is considered highly unlikely that these constitute important habitat to the extent that its removal would threaten the long-term survival of the species.

(e) Whether the action proposed is likely to have an adverse effect on critical habitat (either directly or indirectly).

To date, no critical habitat has been declared under the TSC Act for this species.

Not applicable.

(f) Whether the action proposed is consistent with the objectives or actions of a recovery plan or threat abatement plan.

A recovery plan for this species was prepared by DEC (2006). The recovery plan lists a number of objectives and associated actions to assist in the recovery of the species. The Proposal would not interfere with these objectives and actions.

The Bush Stone-curlew has been assigned to the Landscape management stream. Threatened species in this management stream are distributed across large areas, or are highly mobile and threatened across the landscape by habitat loss and degradation. They are managed using measures such as broad-scale vegetation and habitat management programs, land clearing controls, water management plans and management of national parks and reserves.

The Proposal does not conflict with the management strategies listed for this species.

(g) Whether the action proposed constitutes or is part of a key threatening process or is likely to result in the operation of, or increase the impact of, a key threatening process.

The clearing of native vegetation is listed as a key threatening process under the TSC Act. The Proposal has the potential to adversely affect the Bush Stone-curlew through the loss of native vegetation containing foraging resources and potential breeding habitat.

The loss of dead wood is listed as a key threatening process under the TSC Act. This process has the potential to impact the Bush Stone-curlew.

The Proposal is unlikely to significantly increase the impact of a key threatening process.

Conclusion

Given the highly fragmented and disturbed nature of the habitat to be impacted, the Proposal would not have a significant impact on the Bush Stone-curlew.

A Species Impact Statement is not required.

Pale-headed Snake (*Hoplocephalus bitorquatus*)

The Pale-headed Snake has a patchy distribution from north-east Queensland to the north-eastern quarter of NSW. In NSW it has historically been recorded from as far west as Mungindi and Quambone on the Darling Riverine Plains, across the north-west slopes, and from the north coast from Queensland to Sydney. A small number of historical records are known for the New England Tablelands from Glenn Innes and Tenterfield; however, the majority of records appear to be from sites of relatively lower elevation. Although the Pale-headed snake is very cryptic, it now appears to have contracted to a patchy and fragmented distribution. The Pale-headed Snake is a highly cryptic species that can spend weeks at a time hidden in tree hollows. Found mainly in dry eucalypt forests and woodlands, cypress forest and occasionally in rainforest or moist eucalypt forest. In drier environments, it appears to favour habitats close to riparian areas. Shelter during the day between loose bark and tree-trunks, or in hollow trunks and limbs of dead trees. The main prey is tree frogs although lizards and small mammals are also taken. The Pale-headed Snake is relatively unusual amongst elapid snakes in that it is well adapted to climbing trees.

(a) In the case of a threatened species, whether the action proposed is likely to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction.

The Proposal would result in the removal of open forest habitat that could be suitable for the Pale-headed Snake. The habitat to be removed is fragmented and subject to a high level of disturbance, largely adjacent to the M1 Pacific Motorway. The disturbed nature of this habitat means it is unlikely to be used for breeding.

As such it is unlikely that the Proposal would have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction.

(b) In the case of an endangered population, whether the action proposed is likely to have an adverse effect on the life cycle of the species that constitutes the endangered population such that a viable local population of the species is likely to be placed at risk of extinction.

Not applicable.

(c) In the case of an endangered ecological community or critically endangered ecological community, whether the action proposed:

> **(i) is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction, or**
>
> **(ii) is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction.**

Not applicable.

(d) In relation to a habitat of a threatened species, population or ecological community:

> **(i) the extent to which habitat is likely to be removed or modified as a result of the action proposed, and**
>
> **(ii) whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the Proposal, and**

(iii) the importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species, population or ecological community in the locality.

The Proposal would result in the removal of 22.88 ha of open forest that would provide habitat for the Pale-headed Snake.

The linear nature of the proposed widening would not isolate or fragment any remaining habitat after the clearing has been undertaken.

Much of the area proposed for clearing as part of the Proposal is of a degraded and sub-optimal state for this species. Of the pockets that may be suitable it is considered highly unlikely that these constitute important habitat to the extent that its removal would threaten the long-term survival of the species.

(e) Whether the action proposed is likely to have an adverse effect on critical habitat (either directly or indirectly).

To date, no critical habitat has been declared under the TSC Act for this species.

Not applicable.

(f) Whether the action proposed is consistent with the objectives or actions of a recovery plan or threat abatement plan.

The Pale-headed Snake has been assigned to the Landscape management stream. Threatened species in this management stream are distributed across large areas, or are highly mobile and threatened across the landscape by habitat loss and degradation. They are managed using measures such as broad-scale vegetation and habitat management programs, land clearing controls, water management plans and management of national parks and reserves.

The Proposal does not conflict with the management strategies listed for this species.

(g) Whether the action proposed constitutes or is part of a key threatening process or is likely to result in the operation of, or increase the impact of, a key threatening process.

The clearing of native vegetation and loss of hollow-bearing trees are listed as key threatening processes under the TSC Act. The Proposal has the potential to adversely affect the Pale-headed Snake through the loss of native vegetation containing foraging resources and potential breeding habitat in hollow-bearing trees.

The Proposal is unlikely to significantly increase the impact of a key threatening process.

Conclusion

Given the highly fragmented and disturbed nature of the habitat to be impacted, the Proposal would not have a significant impact on the Pale-headed Snake.

A Species Impact Statement is not required.

Rose-crowned Fruit-dove (*Ptilinopus regina*)

The Rose-crowned Fruit-dove is found in the coast and ranges of eastern NSW and Queensland, from Newcastle to Cape York. Vagrants are occasionally found further south to Victoria. Rose-crowned Fruit-doves occur mainly in sub-tropical and dry rainforest and occasionally in moist eucalypt forest and swamp forest, where fruit is plentiful. They are shy pigeons, not easy to see amongst the foliage, and are more often heard than seen. They feed entirely on fruit from vines, shrubs, large trees and palms, and are thought to be locally nomadic as they follow the ripening of fruits. Some populations are migratory in response to food availability - numbers in north-east NSW increase during spring and summer then decline in April or May.

(a) In the case of a threatened species, whether the action proposed is likely to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction.

The Proposal would result in the removal of a small amount of swamp forest habitat that could be suitable for the Rose-crowned Fruit-dove. The habitat to be removed is fragmented and subject to a high level of disturbance, largely adjacent to the M1 Pacific Motorway. The disturbed nature of this habitat means it is unlikely to be used for breeding.

As such it is unlikely that the Proposal would have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction.

(b) In the case of an endangered population, whether the action proposed is likely to have an adverse effect on the life cycle of the species that constitutes the endangered population such that a viable local population of the species is likely to be placed at risk of extinction.

Not applicable.

(c) In the case of an endangered ecological community or critically endangered ecological community, whether the action proposed:

> **(i) is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction, or**
>
> **(ii) is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction.**

Not applicable.

(d) In relation to a habitat of a threatened species, population or ecological community:

> **(i) the extent to which habitat is likely to be removed or modified as a result of the action proposed, and**
>
> **(ii) whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the Proposal, and**
>
> **(iii) the importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species, population or ecological community in the locality.**

The Proposal would result in the removal of 1.49 ha of swamp forest that would provide habitat for the Rose-crowned Fruit-dove.

The linear nature of the proposed widening would not isolate or fragment any remaining habitat after the clearing has been undertaken.

Much of the area proposed for clearing as part of the Proposal is of a degraded and sub-optimal state for this species. Of the pockets that may be suitable it is considered highly unlikely that these constitute important habitat to the extent that its removal would threaten the long-term survival of the species.

(e) Whether the action proposed is likely to have an adverse effect on critical habitat (either directly or indirectly).

To date, no critical habitat has been declared under the TSC Act for this species.

Not applicable.

(f) Whether the action proposed is consistent with the objectives or actions of a recovery plan or threat abatement plan.

The Rose-crowned Fruit-dove has been assigned to the Landscape management stream. Threatened species in this management stream are distributed across large areas, or are highly mobile and threatened across the landscape by habitat loss and degradation. They are managed using measures such as broad-scale vegetation and habitat management programs, land clearing controls, water management plans and management of national parks and reserves.

The Proposal does not conflict with the management strategies listed for this species.

(g) Whether the action proposed constitutes or is part of a key threatening process or is likely to result in the operation of, or increase the impact of, a key threatening process.

The clearing of native vegetation is listed as a key threatening process under the TSC Act. The Proposal has the potential to adversely affect the Rose-crowned Fruit-dove through the loss of native vegetation containing foraging resources and potential breeding habitat.

The Proposal is unlikely to significantly increase the impact of a key threatening process.

Conclusion

Given the highly fragmented and disturbed nature of the habitat to be impacted, the Proposal would not have a significant impact on the Rose-crowned Fruit-dove.

A Species Impact Statement is not required.

EPBC Act

Regent Honeyeater (*Anthochaera phrygia*) and Swift Parrot (*Lathamus discolor*)

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

- **lead to a long-term decrease in the size of a population**.

The Regent Honeyeater and Swift Parrot are listed as Endangered under the EPBC Act. Regent honeyeaters occur mainly in dry box ironbark open-forest and woodland areas, particularly favouring wet, fertile soils, such as along creek flats and broad river valleys. They also inhabit wet lowland coastal forests dominated by swamp mahogany and spotted gum, which is found within the Proposal Boundary. They spend much of their time feeding on the nectar from eucalypts such as the Mugga Ironbark, White Box and Yellow Box, and Blakeley's Red Gum on which they are reliant. The Regent Honeyeater has specific breeding areas that are not located within the Proposal Boundary. The Swift Parrot utilises a variety of different Eucalypt habitats throughout its breeding and foraging range. These are typically dominated by *E. leucoxylon, E. tricarpa, E. sideroxylon* and *E. microcarpa*. Grey box/yellow gum woodland is also utilised in New South Wales.

The habitat requirements necessary for these species are not abundant within the Proposal Boundary, with limited nesting and foraging habitat available. While most of these resources would not be disturbed by the proposed activity, it is unlikely the area currently contains a substantial population of either Regent Honeyeaters or Swift Parrots. Therefore it is unlikely the proposed actions would lead to a long term decrease in the size of any existing population.

- **reduce the area of occupancy of the species**

The Regent Honeyeater occupies a 300 km^2 area (200 kms^2 in NSW), that is currently decreasing in size, with the species absent from areas it has previously been recorded in. The Swift Parrot occupies approximately 4000 kms^2, an area that also appears to be declining. Massive habitat loss is potentially responsible for the decline in area of occupancy. Any potential loss of foraging habitat is estimated at approximately 22.88 ha.

Given the scale of the area of occupancy compared to the affected habitat within the Proposal Boundary, it is highly unlikely that the Proposal would reduce the occupancy of the Regent Honeyeater or Swift Parrot.

- **fragment an existing population into two or more populations**

No population of either species has been identified within the Proposal Boundary. The proposed works would not substantially increase the divide between vegetation, with mitigation strategies in place to retain remnant vegetation and hollow bearing trees. These species are both highly mobile, with the Regent honeyeater undertaking migratory movements between areas with abundant food supplies (flowering eucalypts and insects) and the Swift Parrot migrating between Tasmania (breeding season) and mainland Australia (non- breeding season).

It is highly unlikely that the Proposal would result in the fragmentation of a potential existing population of Regent Honeyeaters or Swift Parrots.

- **adversely affect habitat critical to the survival of a species**

No critical habitat has been declared for either of these species. Not applicable.

- **disrupt the breeding cycle of a population**

The Swift parrot migrates to Tasmania in breeding season (September - January) from wintering habitat on the Australian mainland. This species shows high site fidelity, but is also influence by resource availability. Breeding success strongly influenced by flowering resources in Tasmania. The Regent Honeyeater breeds from May – March, with an activity peak in September – November linked to flowering of key eucalypt and mistletoe species.

This species has three main breeding site; Capertee Valley and Bundarra-Barraba areas in NSW and north-eastern Victoria.

As this site is outside the breeding areas and has limited foraging resources it is unlikely that the Proposal would disrupt the breeding cycle of a population of either species.

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

The Proposal Boundary only provides limited foraging and roosting opportunities. The species are unlikely to breed in the Proposal Boundary. Any vegetation removed by the Proposal is unlikely to be important to the long-term survival of these species.

It is unlikely that availability or quality of habitat would be reduced to the extent that either species is likely to decline.

- **result in invasive species that are harmful to a critically endangered or endangered species becoming established in the endangered or critically endangered species' habitat**

Sections of the Proposal Boundary are highly disturbed and modified and there is evidence of invasive fauna (i.e. fox and rabbit) and weed species. Mitigation strategies include the retention of remnant vegetation where possible and weed removal/control.

The Proposal is unlikely to result in additional invasive species becoming established.

- **introduce disease that may cause the species to decline**

No diseases have been identified as a threat to the Regent Honeyeater. Beak and feather disease is capable of affecting the Swift Parrot and can result in high nestling mortality. It is spread by the movements of common species carrying the disease.

The Proposal is unlikely to aid the spread of beak and feather disease.

- **interfere with the recovery of the species**

Clearance of large trees and high-quality habitat, grazing preventing native vegetation regeneration and removal of large areas of box-ironbark for harvesting all significantly affect the Regent Honeyeater and Swift Parrot. Abatement of these key threats would be beneficial to the recovery of the species.

Despite the fact that the Proposal would require the removal of vegetation on site, it is not expected that this would adversely impact on the potential for these species to recover in this area, due to the limited amount of habitat to be removed and its low quality as habitat for these species.

References

OEH 2015 Swift Parrot Threatened Species Profile. Accessed 31st August 2015 http://www.environment.nsw.gov.au/threatenedspeciesapp/profile.aspx?id=10455

OEH 2015 Regent Honeyeater Threatened Species Profile. Accessed 31st August 2015 http://www.environment.nsw.gov.au/threatenedSpeciesApp/profile.aspx?id=10841

DoE 2015 Swift Parrot SPRAT Profile. Accessed 31st August 2015 http://www.environment.gov.au/cgi-bin/sprat/public/publicspecies.pl?taxon_id=744

DoE 2015 Regent Honeyeater SPRAT Profile. Accessed 31st August 2015 http://www.environment.gov.au/cgi-bin/sprat/public/publicspecies.pl?taxon_id=82338

Fork-tailed Swift (*Apus pacificus*) and White-throated Needletail (*Hirundapus caudacutus*)

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

substantially modify (including by fragmenting, altering fire regimes, altering nutrient cycles or altering hydrological cycles), destroy or isolate an area of important habitat for a migratory species

The Proposal Boundary is modified and occurs within the context of a busy motorway. Vegetation and habitat in general in this area is likely to be heavily influenced by edge-effects.

Use of the Proposal Boundary by the Fork-tailed Swift and White-throated Needletail would be rare. The relative importance of the affected area in relation to nearby available habitat is considered to be minor.

Given the degraded state of the Proposal Boundary and its infrequency of use, the Proposal would not substantially modify, destroy or isolate an important area of habitat for the Fork-tailed Swift or the White-throated Needletail.

result in an invasive species that is harmful to the migratory species becoming established in an area of important habitat for the migratory species

Given the mitigation measures involved it is unlikely that the Proposal would induce invasive species to become established in any area of important habitat for these species.

The proposed actions are unlikely to result in an invasive species that is harmful to one of the migratory species becoming established in an area of important habitat for the migratory species.

seriously disrupt the lifecycle (breeding, feeding, migration or resting behaviour) of an ecologically significant proportion of the population of a migratory species

Use of the Proposal Boundary by the Fork-tailed Swift and White-throated Needletail would be rare and would not involve an ecologically significant proportion of their populations.

Both species breed in the northern hemisphere.

It is highly unlikely that the proposed actions would disrupt the lifecycle of an ecologically significant proportion of the population of these migratory species.

Conclusion

As the Proposal Boundary provides only intermittent suitable habitat it is considered that the Proposal would not have a significant impact on these migratory species.

Referral to Department of Environment is not required.

Rainbow Bee-eater (*Merops ornatus*)

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

substantially modify (including by fragmenting, altering fire regimes, altering nutrient cycles or altering hydrological cycles), destroy or isolate an area of important habitat for a migratory species

The Proposal Boundary is modified and occurs within the context of a busy motorway. Vegetation and habitat in general in this area is likely to be heavily influenced by edge-effects.

Use of the Proposal Boundary by the Rainbow Bee-eater would be rare. The relative importance of the affected area in relation to nearby available habitat is considered to be minor.

Given the degraded state of the Proposal Boundary and its infrequency of use, the Proposal would not substantially modify, destroy or isolate an important area of habitat for the Rainbow Bee-eater.

result in an invasive species that is harmful to the migratory species becoming established in an area of important habitat for the migratory species

Given the mitigation measures involved it is unlikely that the Proposal would induce invasive species to become established in any area of important habitat for this species.

The proposed actions are unlikely to result in an invasive species that is harmful to the Rainbow Bee-eater becoming established in an area of important habitat.

seriously disrupt the lifecycle (breeding, feeding, migration or resting behaviour) of an ecologically significant proportion of the population of a migratory species

Use of the Proposal Boundary by the Rainbow Bee-eater would be rare and would not involve an ecologically significant proportion of their population.

It is unlikely that the site supports breeding habitat for this species.

It is highly unlikely that the proposed actions would disrupt the lifecycle of an ecologically significant proportion of the population of this species.

Conclusion

As the Proposal Boundary provides only intermittent suitable habitat it is considered that the Proposal would not have a significant impact on this species.

Referral to Department of Environment is not required.

Koala (*Phascolarctos cinereus*)

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

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

Koala habitat surveys undertaken for the original Project REF did not detect the presence of koalas within the Proposal Boundary. Further, whilst the site is listed in the Draft EPBC Act referral guidelines for the vulnerable Koala (DoE 2013) as a known/likely to occur location for the species, an assessment undertaken in accordance with these guidelines indicated that the site did not contain habitat critical to the survival of the koala and therefore it is considered that an important population is not present.

The proposed works are unlikely to lead to a long-term decrease in the size of an important population of koala.

reduce the area of occupancy of an important population

Koala habitat surveys undertaken for the original Project REF did not detect the presence of koalas within the Proposal Boundary. Further, whilst the site is listed in the Draft EPBC Act referral guidelines for the vulnerable koala (Doe 2013) as a known/likely to occur location for the species, an assessment undertaken in accordance with these guidelines indicated that the site did not contain habitat critical to the survival of the koala and therefore it is considered that an important population is not present. The Proposal would involve clearing of 0.27 ha of potential Koala habitat within the Proposal Boundary.

The majority of clearing proposed would occur adjacent to the M1 Pacific Motorway, roadside or cleared land in areas subject to fragmentation. Koalas are capable of moving large distances in search of food, with home ranges between two and several hundred ha.

It is unlikely that a population exists within the Proposal Boundary. Therefore it is unlikely the proposed actions would reduce the area of occupancy of any potential important population.

fragment an existing important population into two or more populations

Koala habitat surveys undertaken for the original Project REF did not detect the presence of koalas within the Proposal Boundary. Further, whilst the site is listed in the Draft EPBC Act referral guidelines for the vulnerable koala (Doe 2013) as a known/likely to occur location for the species, an assessment undertaken in accordance with these guidelines indicated that the site did not contain habitat critical to the survival of the koala and therefore it is considered that an important population is not present.

It is unlikely that an important population would be fragmented.

adversely affect habitat critical to the survival of a species

Koala habitat surveys undertaken for the original Project REF did not detect the presence of koalas within the Proposal Boundary. Further, whilst the site is listed in the Draft EPBC Act referral guidelines for the vulnerable koala (Doe 2013) as a known/likely to occur location for the species, an assessment undertaken in accordance with these guidelines indicated that the site did not contain habitat critical to the survival of the koala.

The proposed actions are unlikely to adversely affect habitat critical to the survival of this species.

disrupt the breeding cycle of an important population/s

Koala habitat surveys undertaken for this project did not detect the presence of koalas within the Proposal Boundary. Further, whilst the site is listed in the Draft EPBC Act referral guidelines for the vulnerable koala (Doe 2013) as a known/likely to occur location for the species, an assessment undertaken in accordance with these guidelines indicated that the site did not contain habitat critical to the survival of the koala.

The proposed actions are unlikely to disrupt the breeding cycle of any potential important koala population.

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

It is unlikely that the availability or quality of koala habitat would be altered to the extent that the species is likely to decline.

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

The proposed works do not involve procedures that are likely to increase the potential for invasive species to be present if best practice techniques are employed.

With adherence to best practice construction techniques and ongoing management, the Proposal would not result in invasive species that are harmful to a vulnerable species becoming established in the species' habitat.

introduce disease that may cause the species to decline

The proposed works do not involve procedures that are likely to increase the potential for introduced diseases to be present if best practice techniques are employed.

With adherence to best practice construction techniques and ongoing management, the Proposal would not introduce disease that may cause the species to decline.

interfere substantially with the recovery of the species

It is unlikely that the actions proposed would interfere substantially with the recovery of the species.

Conclusion

The proposed development is not considered to significantly impact upon the koala. This is due to the low value of the potential habitat to be cleared, the small amount of potential koala habitat to be impacted, the lack of signs of koalas present and the mitigation measures provided.

A referral to Department of the Environment is not required.

New Holland Mouse (*Pseudomys novaehollandiae*)

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

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

This species has a fragmented distribution, with 6-8 metapopulations. There is a lack of detailed survey data which makes it difficult to estimate the species actual distribution. Broadly this species inhabits coastal areas and up to 100 km inland in sandstone country and can be found in open heathland, open woodland with healthy understorey and vegetated sand dune. Populations are mainly known from reserves and have a preference for floristically rich habitat. The sections of the Proposal Boundary to be affected primarily contain disturbed, modified vegetation with limited or no mid/under-storey.

It is unlikely that the proposed actions would lead to a long-term decrease in the size of an important population of new Holland mouse.

reduce the area of occupancy of an important population

This species is social, living in shared burrows with several individuals. The estimated extent of occurrence for this species is estimated around 90,000 km2 and the species area of occupancy estimated as 420 km2. Populations are small, with restricted home ranges of 0.4-1.4 ha.

The proposed actions are primarily centered on the existing road and clearing in the median strip. It is unlikely that a population of New Holland mouse exist in these disturbed areas, when remnant vegetation is available nearby. Therefore it is unlikely that there would be a reduction in area of occupancy of an important population.

fragment an existing important population into two or more populations

The majority of disturbance would occur in highly modified areas that have been previously cleared and fragmented. The majority of remnant vegetation would be retained on site.

It is unlikely that the proposed actions would fragment an existing important population.

adversely affect habitat critical to the survival of a species

No critical habitat has been identified for this species.

Not applicable.

disrupt the breeding cycle of an important population/s

Individuals reach sexual maturity around 13 weeks of age in females and 20 weeks in males. This species breeds between late winter and early summer. Timing is related to the abundance and quality of food, rainfall patterns and fire succession. The species feeds primarily on seeds, and can consume leaves, fungi and invertebrates.

As the proposed actions are unlikely to affect nutritional resources, it is also unlikely that the breeding cycle of any potential population would be disrupted.

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

The New Holland mouse has a preference for floristically rich and diverse habitats. These types of habitats are more likely to be found in the remnant vegetation within the Proposal Boundary. This remnant vegetation is to be retained (where possible), with a small portion of the Proposal Boundary to be removed.

It is unlikely that the proposed actions would decrease the availability or quality of habitat to the extent that the species is likely to decline.

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

Sections of the Proposal Boundary are highly disturbed and modified and there is evidence of invasive fauna (i.e. Fox and Rabbit) and weed species. Mitigation strategies include the retention of remnant vegetation where possible and weed removal/control.

The proposed actions are unlikely to result in additional invasive species becoming established.

introduce disease that may cause the species to decline

Die-back induced by *Phytophthora cinnamomi* has been identified as a threat to the New Holland Mouse. The proposed works do not involve procedures that are likely to increase the potential for introduced diseases to be present if best practice techniques are employed.

With adherence to best practice construction techniques and ongoing management, the Proposal would not introduce disease that may cause the species to decline.

interfere substantially with the recovery of the species

Threats to this species include loss and modification of habitat, weed invasion, overgrazing, die-back, predation by invasive predators and climate change. While a small amount of potential habitat would be lost, it is minimal. The proposed actions are unlikely to exacerbate any of the additional threats to the New Holland mouse.

It is unlikely that the proposed actions would interfere with the recovery of this species.

Conclusion

It is unlikely that the proposed actions would have a negative impact on the New Holland mouse due to the high level of existing disturbance to part of the Proposal Boundary and the mitigation strategies in place.

A referral to Department of the Environment is not required.

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

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

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

Habitat on the site is highly modified with only a small amount of feed tree species (flowering Eucalypts and Melaleucas), no fruiting trees and limited shelter tree species potentially available. No sign was identified of this species during surveys onsite and it is highly unlikely that a local population exists.

The mature trees that are to be affected as part of the proposed works are not considered to provide foraging resources suitable to sustain a local Grey-headed flying-fox population. Therefore the extent of flying-fox habitat to be removed or modified is minor. The proposed works would not lead to a long-term decrease in the size of an important population.

reduce the area of occupancy of an important population

This species requires foraging resources and roosting sites. Roosting sites have large numbers of Grey-headed flying-foxes congregating in large trees. No sign was identified of this species during surveys onsite and it is highly unlikely that a local population exists.

The mature trees that are to be affected as part of the proposed works are not considered to provide foraging resources suitable to sustain a Grey-headed flying-fox population. Therefore the extent of habitat to be removed or modified is minor. The proposed works would not reduce the areas of occupancy of an important population.

fragment an existing important population into two or more populations

Grey-headed flying-foxes can travel up to 60-70 km per night in search of foraging resources and migrates in response to changes in amount and location of flowering. No sign was identified of this species during surveys onsite and it is highly unlikely that a local population exists. Remnant vegetation would be retained on site which would limit further fragmentation of habitat.

Given the restricted habitat available, this species ability to adapt foraging behaviour to resource availability and high level of mobility, it is highly unlikely that the proposed actions would result in the fragmentation of an existing important population of Grey-headed flying-fox.

adversely affect habitat critical to the survival of a species

No critical habitat has been declared for this species.

Not applicable

disrupt the breeding cycle of an important population/s

Following breeding, females relocate with young to maternal camps. No roosting sites or maternal camps were identified on site. No sign was identified of this species during surveys onsite and it is highly unlikely that a local population exists.

Given that important resources for breeding are not available on site, it is highly unlikely that the proposed actions would disrupt the breeding cycle of an important population.

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

Habitat within the Proposal Boundary to be affected by the Proposal is highly modified with only a small amount of feed tree species (flowering Eucalypts and Melaleucas), no fruiting trees and limited shelter tree species potentially available. No sign was identified of this species during

surveys onsite and it is highly unlikely that a local population exists. Grey-headed flying-foxes can travel up to 60-70 km per night in search of foraging resources and migrates in response to changes in amount and location of flowering. Some large trees would be retained on site adjacent to roadside vegetation which would limit further fragmentation of habitat.

The proposed actions are highly unlikely to decrease the availability or quality of habitat to the extent that the species is likely to decline.

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

The proposed works do not involve procedures that are likely to increase the potential for invasive species to be present if best practice techniques are employed.

With adherence to best practice construction techniques and ongoing management, the Proposal would not result in invasive species that are harmful to a vulnerable species becoming established in the species' habitat.

introduce disease that may cause the species to decline

The proposed works do not involve procedures that are likely to increase the potential for introduced diseases to be present if best practice techniques are employed.

With adherence to best practice construction techniques and ongoing management, the Proposal would not introduce disease that may cause the species to decline.

interfere substantially with the recovery of the species

An action plan has been developed and recovery strategies for the Grey-headed flying-fox include abatement of threats such as habitat loss and fragmentation, competition and hybridisation, pollutants and pathogens.

While a small amount of potential habitat would be cleared, mitigation measures recommend the retention of mature and remnant vegetation where possible. Therefore it is unlikely that the actions proposed would interfere substantially with the recovery of the species.

Conclusion

The proposed development is not considered to significantly impact on the Grey-headed flying-fox. This is due to the low value of the potential habitat to be affected and the lack of breeding/roosting camps.

A referral to Department of the Environment is not required.

Long-nosed Potoroo (*Potorous tridactylus*)

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

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

While the Proposal is within the known range of this species there are no records of its occurrence within 10 km on the NSW Wildlife Atlas. As such it is not expected that there are any important populations of this species in the vicinity of the Proposal.

A maximum of 22.88 ha of potential Long-nosed Potoroo habitat would be removed as part of this Proposal. This represents less than 0.1% of nearby available habitat. As such it is unlikely that the Proposal would have an adverse effect on the size of an important population.

The proposed works are unlikely to lead to a long-term decrease in the size of an important population of Long-nosed Potoroo.

reduce the area of occupancy of an important population

While the Proposal is within the known range of this species there are no records of its occurrence within 10 km on the NSW Wildlife Atlas. As such it is not expected that there are any important populations of this species in the vicinity of the Proposal.

It is unlikely the proposed actions would reduce the area of occupancy of any potential important population.

fragment an existing important population into two or more populations

While the Proposal is within the known range of this species there are no records of its occurrence within 10 km on the NSW Wildlife Atlas. As such it is not expected that there are any important populations of this species in the vicinity of the Proposal.

It is unlikely that an important population would be fragmented.

adversely affect habitat critical to the survival of a species

While the Proposal is within the known range of this species there are no records of its occurrence within 10 km on the NSW Wildlife Atlas. As such it is not expected that there is any critical habitat to the survival of this species present within the Proposal Boundary.

The proposed actions are unlikely to adversely affect habitat critical to the survival of this species.

disrupt the breeding cycle of an important population/s

While the Proposal is within the known range of this species there are no records of its occurrence within 10 km on the NSW Wildlife Atlas. As such it is not expected that there are any important populations of this species in the vicinity of the Proposal.

The proposed actions are unlikely to disrupt the breeding cycle of any potential important koala population.

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

The Proposal would lead to a minor reduction in the in the availability of habitat through the clearing of a strip of land adjacent to the existing motorway and patches of vegetation in the ancillary sites. This clearing would remove a maximum of 22.88 ha of potential Long-nosed Potoroo habitat. This represents less than 0.1% of nearby available habitat. As such it is

unlikely that the Proposal would have an adverse effect on the species such that it is likely to decline.

It is unlikely that the Proposal would have an adverse effect on the species such that it is likely to decline.

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

The proposed works do not involve procedures that are likely to increase the potential for invasive species to be present if best practice techniques are employed.

With adherence to best practice construction techniques and ongoing management, the Proposal would not result in invasive species that are harmful to a vulnerable species becoming established in the species' habitat.

introduce disease that may cause the species to decline

The proposed works do not involve procedures that are likely to increase the potential for introduced diseases to be present if best practice techniques are employed.

With adherence to best practice construction techniques and ongoing management, the Proposal would not introduce disease that may cause the species to decline.

interfere substantially with the recovery of the species

The proposed works constitutes part of the key threatening process of 'clearing native vegetation'. As has been established above however, the proportion of habitat to be cleared relative to nearby available habitat (less than 0.1%) means that this Proposal is unlikely to interfere substantially with the recovery of this species.

It is unlikely that the actions proposed would interfere substantially with the recovery of the species.

Conclusion

The proposed development is not considered to have a negative impact upon the Long-nosed Potoroo. This is due to the small amount of habitat to be removed, the lack of any records for this species within a 10 km radius of the Proposal and the mitigation measures provided.

A referral to Department of the Environment is not required.

Southern Brown Bandicoot (*Isoodon obesulus*)

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

- **lead to a long-term decrease in the size of a population**.

The Southern Brown Bandicoot is found in heath or open forest with a heathy understorey on sandy or friable soils. It nests in a shallow depression in the ground covered by vegetation. It searches for insects or underground-fruiting fungi by digging conical holes in the soil.

The Proposal would result in the removal of open forest that the species inhabit. The habitat to be removed is fragmented and subject to a high level of disturbance, largely adjacent to the M1 Pacific Motorway. Therefore it is unlikely the Proposal would lead to a long term decrease in the size of any existing population.

- **reduce the area of occupancy of the species**

The Proposal would result in the removal of 22.88 ha of open forest that is subject to a high level of disturbance, largely adjacent to the M1 Pacific Motorway. Given the scale of the area of occupancy compared to the affected habitat within the Proposal Boundary, it is highly unlikely that the Proposal would reduce the occupancy of the Southern Brown Bandicoot.

- **fragment an existing population into two or more populations**

No population of the species has been identified within the Proposal Boundary. The Proposal would not substantially increase the divide between vegetation.

It is highly unlikely that the Proposal would result in the fragmentation of a potential existing population of Southern Brown Bandicoots.

- **adversely affect habitat critical to the survival of a species**

No critical habitat has been declared for the species. Not applicable.

- **disrupt the breeding cycle of a population**

The species could breed in the areas of vegetation to be cleared, however, the habitat is suboptimal due to the proximity to the M1 Pacific Motorway and level of fragmentation. As such, it is unlikely that the Proposal would disrupt the breeding cycle of a population of Southern Brown Bandicoots species.

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

The Proposal Boundary only provides suboptimal habitat. The species is unlikely to breed in the Proposal Boundary due to the level of disturbance and habitat fragmentation. Any vegetation removed by the Proposal is unlikely to be important to the long-term survival of these species.

It is unlikely that availability or quality of habitat would be reduced to the extent that the species is likely to decline.

- **result in invasive species that are harmful to a critically endangered or endangered species becoming established in the endangered or critically endangered species' habitat**

Sections of the Proposal Boundary are highly disturbed and modified and there is evidence of invasive fauna (i.e. fox and rabbit) and weed species. Mitigation strategies include the retention of remnant vegetation where possible and weed removal/control.

The Proposal is unlikely to result in additional invasive species becoming established.

- **introduce disease that may cause the species to decline**

The Proposal is unlikely to aid the spread of a disease that may cause the species to decline.

- **interfere with the recovery of the species**

Given the existing range of the species and the highly fragmented and disturbed nature of the habitats to be impacted, the Proposal would not have a significant impact on the Southern Brown Bandicoot.

A referral to Department of the Environment is not required.

Eastern Osprey (*Pandion cristatus*)

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

substantially modify (including by fragmenting, altering fire regimes, altering nutrient cycles or altering hydrological cycles), destroy or isolate an area of important habitat for a migratory species

The Proposal Boundary is modified and occurs within the context of a busy motorway. Vegetation and habitat in general in this area is likely to be heavily influenced by edge-effects.

Use of the Proposal Boundary by the Eastern Osprey would be rare. The relative importance of the affected area in relation to nearby available habitat is considered to be minor.

Given the degraded state of the Proposal Boundary and its infrequency of use, the Proposal would not substantially modify, destroy or isolate an important area of habitat for the Eastern Osprey.

result in an invasive species that is harmful to the migratory species becoming established in an area of important habitat for the migratory species

Given the mitigation measures involved it is unlikely that the Proposal would induce invasive species to become established in any area of important habitat for this species.

The proposed actions are unlikely to result in an invasive species that is harmful to the Eastern Osprey becoming established in an area of important habitat.

seriously disrupt the lifecycle (breeding, feeding, migration or resting behaviour) of an ecologically significant proportion of the population of a migratory species

Use of the Proposal Boundary by the Eastern Osprey would be rare and would not involve an ecologically significant proportion of their population.

It is unlikely that the site supports breeding habitat for this species.

It is highly unlikely that the proposed actions would disrupt the lifecycle of an ecologically significant proportion of the population of this species.

Conclusion

As the Proposal Boundary provides only intermittent suitable habitat it is considered that the Proposal would not have a significant impact on this species.

Referral to Department of Environment is not required.

Cattle Egret (*Ardea ibis*) and Great Egret (*Ardea alba*)

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

substantially modify (including by fragmenting, altering fire regimes, altering nutrient cycles or altering hydrological cycles), destroy or isolate an area of important habitat for a migratory species

The Proposal Boundary is modified and occurs within the context of a busy motorway. Vegetation and habitat in general in this area is likely to be heavily influenced by edge-effects.

Use of the Proposal Boundary by the Cattle Egret or Great Egret would be rare. The relative importance of the affected area in relation to nearby available habitat is considered to be minor.

Given the degraded state of the Proposal Boundary and its infrequency of use, the Proposal would not substantially modify, destroy or isolate an important area of habitat for the two egrets.

result in an invasive species that is harmful to the migratory species becoming established in an area of important habitat for the migratory species

Given the mitigation measures involved it is unlikely that the Proposal would induce invasive species to become established in any area of important habitat for this species.

The proposed actions are unlikely to result in an invasive species that is harmful to the egrets becoming established in an area of important habitat.

seriously disrupt the lifecycle (breeding, feeding, migration or resting behaviour) of an ecologically significant proportion of the population of a migratory species

Use of the Proposal Boundary by the Cattle Egret or Great Egret would be rare and would not involve an ecologically significant proportion of their population.

It is highly unlikely that the proposed actions would disrupt the lifecycle of an ecologically significant proportion of the population of these species.

Conclusion

As the Proposal Boundary provides only intermittent suitable habitat it is considered that the Proposal would not have a significant impact on either species.

Referral to Department of Environment is not required.