4. Existing environment

4.1 Vegetation communities

Vegetation within and adjacent to the alignment was previously mapped as part of the *Native Vegetation Maps of the Cumberland Plain* (NSW National Parks and Wildlife Service 2002d).

While the majority of the study area is not mapped as containing native vegetation, three communities are mapped as occurring within the subject site, with a fourth mapped as occurring in adjacent areas (Figure 4-1). All are listed as Threatened ecological communities (Table 4-1). These communities are discussed below.

Table 4-1 Vegetation mapped as occurring within and adjacent to the study area

Vegetation mapping unit[1]	Threatened community	TSC Act[2]	EPBC Act[3]	Mapping within study area	Location and extent within study area verified during field surveys
Shale Plains Woodland	Cumberland Plain Woodland	E	E	Two patches of this community are mapped within the study area: ▪ between Riverstone and Schofields stations ▪ north of Quakers Hill Station. It also occurs adjacent to the study area.	Seven small patches of this community occur within the subject site: ▪ three small patches to the south of Schofields Station ▪ four patches to north of Quakers Hill Station. It also occurs adjacent to the study area.
Alluvial Woodland	River-Flat Eucalypt Forest on Coastal Floodplains	E	-	One narrow strip is mapped within the rail corridor, to the north of Quakers Hill Station. This community also occurs in adjacent areas.	Five patches were recorded within the subject site, to the north of Quakers Hill Station. This community also occurs in adjacent areas.
Shale Gravel Transition Forest	Shale Gravel Transition Forest	E	-	Mapped as occurring extensively in the vicinity of Vineyard and to the north of Riverstone.	Occurs within study area south from Bandon Road, including within proposed locations for the new Vineyard Station, bus interchange and car park.
Cooks River Castlereagh Ironbark Forest	Cooks River Castlereagh Ironbark Forest	E		Mapped as occurring near the study area, to the north-east of Vineyard.	Outside study area.

1: Cumberland Plain vegetation mapping (NSW National Parks and Wildlife Service 2002d)

2: listed under the TSC Act as Endangered (E).

3: listed under the EPBC Act as Endangered (E).

4.1.1 Shale Plains Woodland

Shale Plains Woodland occurs on the Cumberland Plain, predominantly on soils derived from Wianamatta Shale and is a sub-unit of Cumberland Plain Woodland (NSW Scientific Committee 2008). Cumberland Plain Woodland is currently listed as Endangered under the EPBC Act and the TSC Act. However there is a preliminary determination to list this community as Critically Endangered under the TSC Act (NSW Scientific Committee 2008). This preliminary determination was on public exhibition until 23 January 2009, a final determination has yet to be made by the Scientific Committee.

Most of the remnants of Shale Plains Woodland that are mapped within the study area are classified as 'other remnant vegetation' (conservation significance assessment class, NSW National Parks and Wildlife Service 2002a). One area of Shale Plains Woodland mapped as occurring north of Schofields Station is classified as 'support for core habitat' (conservation significance assessment class, NSW National Parks and Wildlife Service 2002a), however, the vegetation in the rail corridor in this area was highly degraded and did not support this community.

Remnants of Shale Plains Woodland within the study area generally consisted of isolated trees including *Eucalyptus crebra, E. moluccana* and *E. tereticornis* regrowth with few large remnant trees providing less than 10% canopy cover. Some remnants also had small trees in the sub-canopy such as *Melaleuca decora* and *Exocarpos cupressiformis.* The best quality patches observed were located within the Department of Defence lands north of Quakers Hill Station where the ground cover was largely dominated by native understorey species. Most patches within the study area lacked a shrub layer, although some areas contained isolated native shrubs, including *Bursaria spinosa* and *Acacia decurrens*. The ground cover was generally dominated by introduced grasses, herbs and vines, such as *Asparagus asparagoides, Myrsiphyllum asparagoides, Thunbergia alata, Eragrostis curvula,* however, also included native species such as *Themeda australis*, *Microlaena stipoides, Eiandia spp., Iomandra spp Cheilanthes sieberi* and scattered *Bursaria spinosa*.

Photo 4-1 Shale Plain Woodland within the rail corridor

4.1.2 Alluvial Woodland

Alluvial Woodland occurs exclusively in association with drainage lines (NSW National Parks and Wildlife Service 2002a) and was restricted to two unnamed tributaries of Eastern Creek, north of Quakers Hill and Schofields (refer Photo 4-2) stations (refer Figure 4-1). Both remnant patches of this community are classed as 'other remnant vegetation' (NSW National Parks and Wildlife Service 2002a).

Alluvial Woodland is a diverse vegetation community that can be dominated by a range of different species depending on the adjacent vegetation community (NSW National Parks and Wildlife Service 2002a). Within the rail alignment, the Alluvial Woodland canopy and sub-canopy were dominated by *E. amplifolia, E. tereticornis* and *Angophora floribunda* as emergents over dense patches of *Casuarina glauca* and *Melaleuca* spp. This community generally lacked a shrub layer and the ground cover was dominated by introduced species such as *Asparagus asparagoides, Myrsiphyllum asparagoides, Tradescanita abliflora, Avena fatua* and *Foeniculum vulgare.*

Patches of this community along the alignment were small, fragmented, edge-affected and ranged in condition from medium to poor.

Depending on the species composition of the patch, Alluvial Woodland may be consistent with either River-Flat Eucalypt Forest on Coastal Floodplains of the NSW North Coast, Sydney Basin and South East Corner Bioregions, or Swamp Oak floodplain forest of the NSW North Coast, Sydney Basin and South East Corner bioregions (Department of Environment and Climate Change 2007a, 2007b). Both of these communities are listed as Endangered under the TSC Act. Due to the species composition of this community at the site — eucalypt dominated — it is consistent with River-Flat Eucalypt Forest on Coastal Floodplains (Department of Environment and Climate Change 2007a).

Photo 4-2 Alluvial woodland to east of rail corridor, north of Schofields Station

Figure 4-1a Vegetation communities and threatened species within the study area

Note: Project detail shown is indicative only, subject to detailed design.

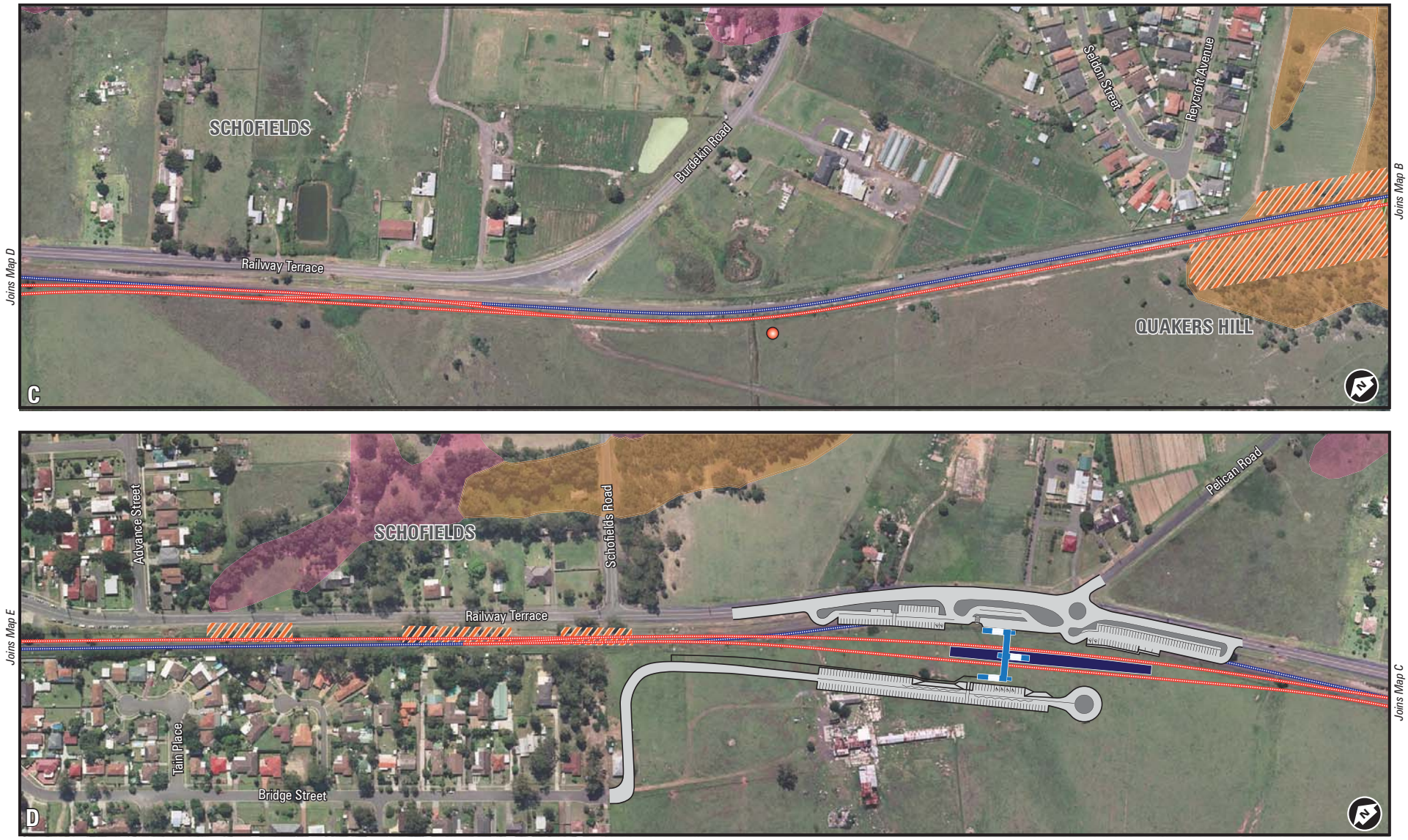

Figure 4-1b Vegetation communities and threatened species within the study area

Note: Project detail shown is indicative only, subject to detailed design.

Figure4-1c Vegetation communities and threatened species within the study area

Note: Project detail shown is indicative only, subject to detailed design.

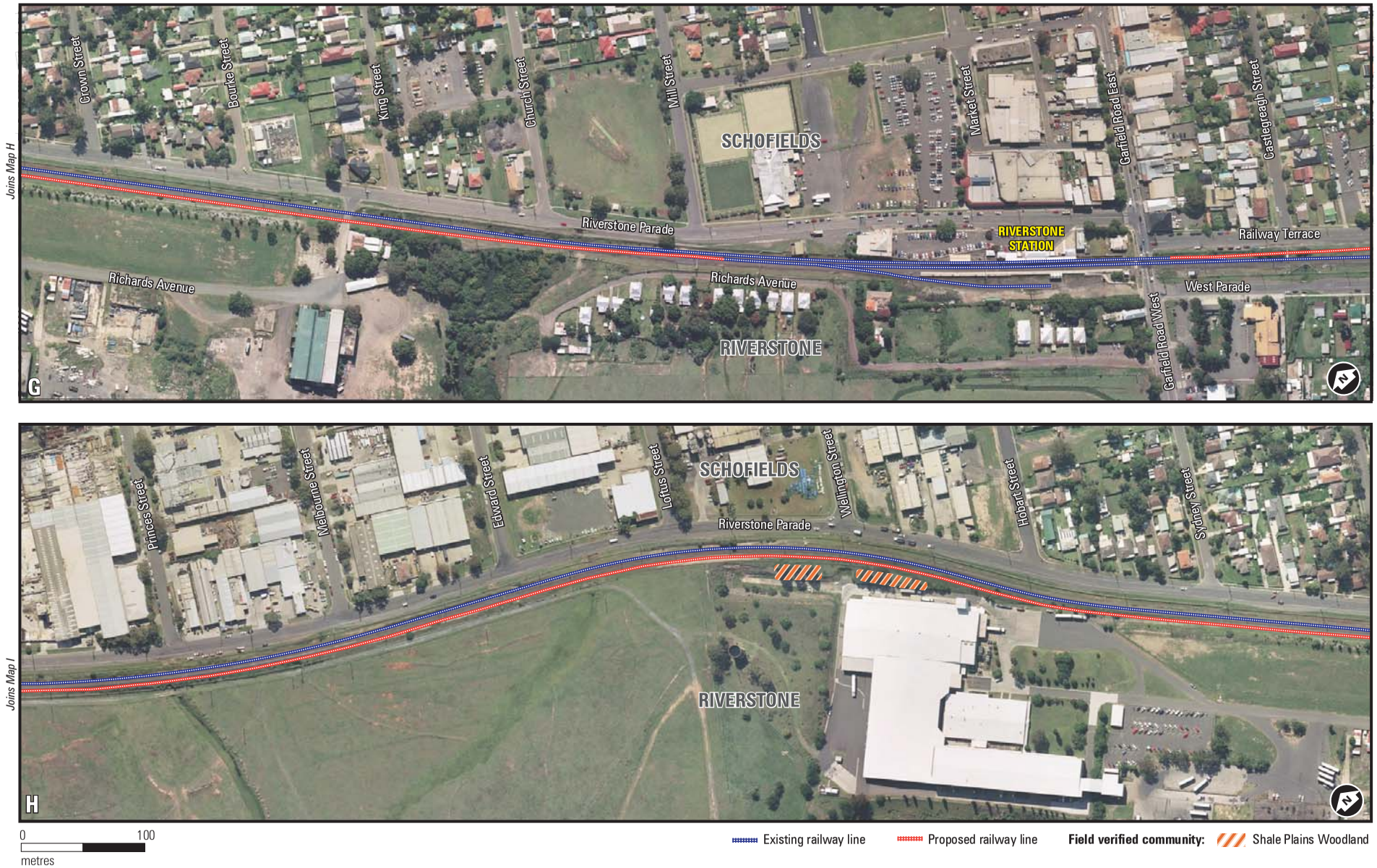

Figure 4-1d Vegetation communities and threatened species within the study area

Note: Project detail shown is indicative only, subject to detailed design.

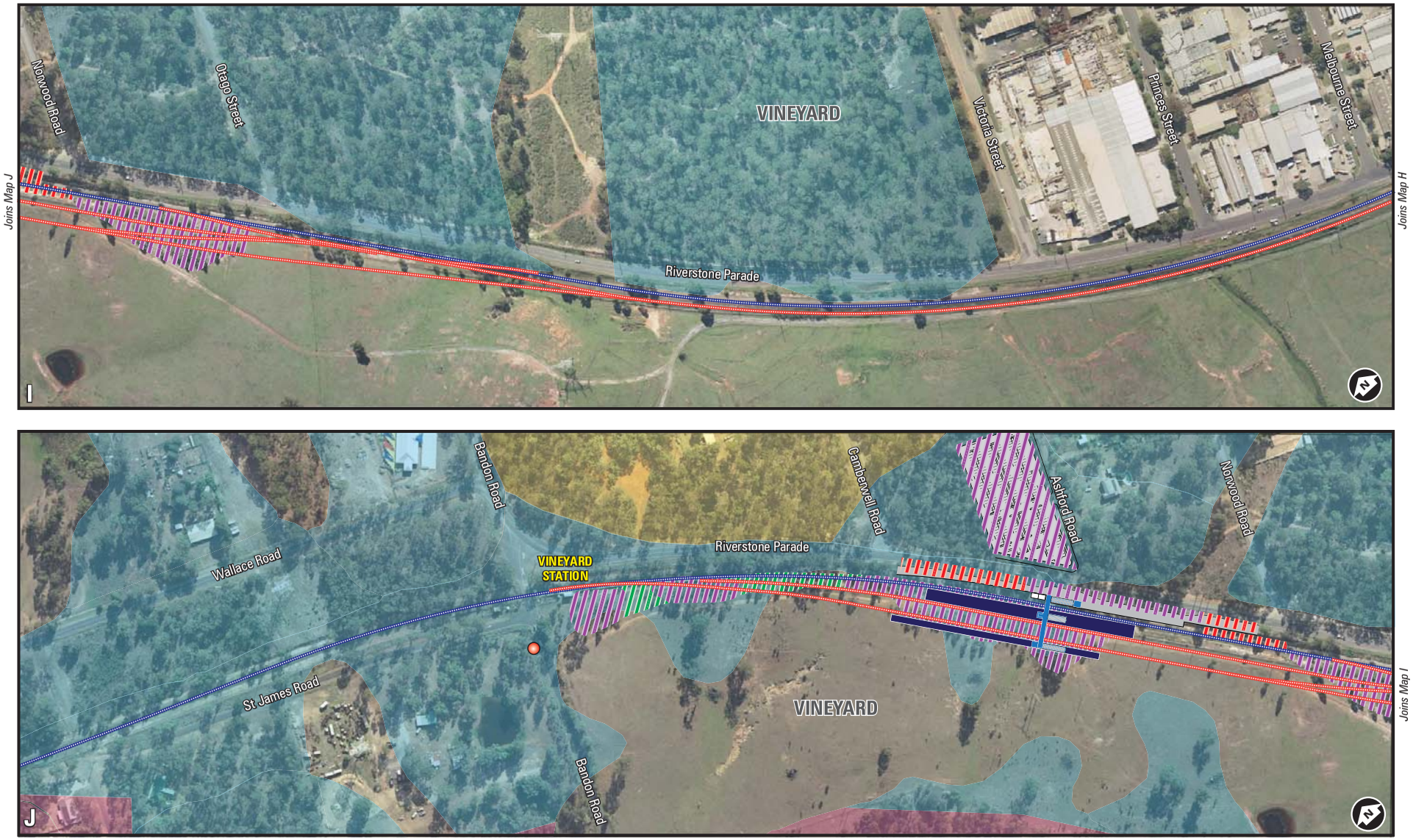

Figure 4-1e Vegetation communities and threatened species within the study area

Note: Project detail shown is indicative only, subject to detailed design.

4.1.3 Shale Gravel Transition Forest and derived grassland

Shale Gravel Transition Forest occurs primarily in association with Shale Plains Woodland. Fragments of this community were identified to the south of Bandon Road, along the proposed new rail line, and within part of the proposed new Vineyard Station as well as within the proposed bus interchange and car park (refer Figure 4-1).

New Vineyard Station car park

Within the proposed new Vineyard Station car park area, this community occurs as a tall forest dominated by *E. tereticornis* and *E. fibrosa* (refer Photo 4-3). A patchy, low canopy of *Melaleuca sieberi* was present (to 5 metres tall). A patchy tall shrub layer (2 to 3 metres tall) was present with locally dense patches of *Bursaria spinosa, Daviesia ulicifolia, Acacia decurrens* and *Acacia elongata.* A sparse, low shrub layer was also present (to 1 metre) dominated by *Melaleuca thymifolia.*

Although the margins (approximately 5 metres wide) of this remnant patch are dominated by the introduced *Eragrostis curvula,* beyond the influence of edge effects this patch has a high diversity of native ground cover species and few weeds were recorded. The ground layer was dominated by native grasses such as *Themeda australis, Microlaena stipoides, Aristida vagans, Entolasia marginata* as well as herbs such as *Pratia purpurascens, Lomandra* spp., *Brunoniella australis* and *Dichondra repens*.

This area had a high diversity of native species, and recruitment of native species was evident, with eucalypts of a range of ages recorded and soil appearing undisturbed with extensive lichen and moss cover. This area was in good condition and is classed as ‘core habitat’ (conservation significance assessment class, NSW National Parks and Wildlife Service 2002a).

Photo 4-3 Shale Gravel Transition Forest: Area proposed for a car park at Vineyard

New Vineyard Station bus interchange

The proposed bus interchange site consists of a narrow (up to 3 metre wide) strip of regrowth Shale Gravel Transition Forest occurring between Riverstone Parade and the existing rail corridor. This area displays a high level of disturbance, including past clearing, weed invasion and roadside litter. The ground cover in this area is patchy and consists of a mix of native ground cover species as well as the introduced *Eragrostis curvula*. Although disturbed, this area was in moderate condition and supported the Threatened *Pultenaea parviflora* (54 plants).

Photo 4-4 Shale Gravel Transition Forest: Area proposed for a bus interchange

New Vineyard Station and associated track

To the west of the existing rail line, within the area of the proposed new Vineyard Station and associated rail line, Shale Gravel Transition Forest occurred as young regrowth vegetation, with eucalypts generally to 6 metres tall within a cleared and grazed landscape (refer Photo 4-4). Grazing of this area appeared to have ceased recently and although regeneration of eucalypts was evident, including within the grassland area (up to 1 metre tall), no regeneration of shrubs was evident. Ten metres beyond the road edge, the groundcover was dominated by native herbs and grasses such as *Aristida* spp., *Cheilanthes sieberi* and *Themeda australis*.

Derived grassland also occurred in this area and consisted of native species characteristic of Shale Gravel Transition Forest (Figure 4-1). The native ground cover was largely restricted to within a few metres of the rail corridor fence and in the understorey of regrowth woodland patches.

The vegetation in this area generally had little weed invasion and given time is likely to regenerate.

Photo 4-5 Shale Gravel Transition Forest: Area proposed for new Vineyard Station and associated track work

4.2 Flora

A total of 239 species of plant were recorded in the study area. Of these, 135 (56%) were native species. The site was dominated by Poaceae, Fabaceae and Asteraceae. A full list of species recorded is provided in Appendix A.

Two Threatened species of plant, *Pultenaea parviflora* and *Grevillea juniperina* subsp *juniperina,* was recorded in the study area (see Section 5.3 for details and Figure 4-1). No other rare or threatened species were recorded.

4.2.1 Weeds

Ninety-nine species of weed were recorded, corresponding to 44% of the species recorded in the study area (Appendix A). This included 17 species listed as noxious weeds in the Hawkesbury River County Council noxious weed control area (includes Blacktown local government area). Of these, three are also listed as weeds of national significance (Table 4-2).

A full list of weeds is provided in Appendix A.

Table 4-2 Noxious weeds recorded in the study area

Scientific name	Common name	Noxious weed[1]	WONS[2]
Bryophyllum delagoense	Mother of Millions	3	
Brassica rapa		3	
Cestrum parqui	Green Cestrum	3	
Cortaderia selloana	Pampas Grass	3	
Ageratina adenophora	Crofton Weed	4	
Echinochloa frumentacea	Siberian Millet	4	
Echium plantagineum		4	
Hypericum perforatum	St. Johns Wort	4	
Ligustrum lucidum	Large-leaved Privet	4	
Ligustrum sinense	Small-leaved Privet	4	
Lycium ferocissimum	African Boxthorn	4	
Opuntia stricta	Prickly Pear	4	
Rubus fruticosus	Blackberry complex	4	Y
Asparagus asparagoides	Bridal Creeper	5	Y
Lantana camara	Lantana	5	Y
Oxalis corniculata	Creeping Oxalis	5	
Oxalis latifolia	Fishtail oxalis	5	

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

2. Weeds of National Significance (Thorp & Lynch 2000).

4.3 Fauna habitats

Suitability, size and configuration of fauna habitats correlate broadly with the structure, floristics, connectivity and quality of the local and regional vegetation types as described above. Habitat features along the rail corridor generally include those associated with cleared areas, disturbed regrowth vegetation and riparian habitats. The habitats and species associations in the site are discussed below.

4.3.1 Maintained rail corridor and road reserve

There are limited fauna habitat features in the rail corridor, as the vegetation has been cleared and/or maintained (mown or slashed) in most areas. Areas that have not been maintained (steeper areas adjacent to the rail track) provide foraging habitat and refuge for common reptiles, including the Grass Sun Skink (*Lampropholis delicata*) and Blue Tongue Lizard (*Tiliqua scincoides*), as well as foraging and nesting habitats for small birds including fairywrens, finches and Willie Wagtail (*Rhipidura leucophrys*). Other generalist species of bird, including the Australian Magpie (*Gymnorhina tibicen*), Laughing Kookaburra (*Dacelo novaeguineae*) and Australian Raven (*Corvus coronoides*) forage in the open and cleared areas.

Isolated eucalypt trees occur along the rail corridor and road reserve including both locally indigenous species and non-endemic plantings. The majority of these were *Eucalyptus tereticornis* with *Angohora floribunda* also common. Trees were generally young and none were observed to have hollows. Species such as *Eucalyptus tereticornis* and *E. viminals* were noted to have suitable temporary roost sites for microbats. These trees would provide roosting and nesting habitats for generalist species of bird.

The numerous *Angophora floribunda* specimens that were scattered within the landscape should be also noted to be a secondary food resource for the Threatened Glossy Black-cockatoo listed as Vulnerable under TSC Act.

The majority of the site was dominated by cleared areas and consequently offers limited habitat features for native species of animal. Fauna habitats in the rail and road corridor were generally in poor condition.

4.3.2 Remnant vegetation

Remnant vegetation in the study area occurs as fragments or isolated trees, with remnant forest and woodland largely restricted to the proposed bus interchange and car park site at Vineyard. This site contains Shale Gravel Transition Forest as described above.

Areas of forest and woodland contained older trees and provided greater habitat complexity for fauna in the form of fallen trees and dense understorey vegetation. These attributes were being used by the Yellow Thornbill (*Acanthiza nana*), White-plume Honeyeater (*Lichenostomus ornatus*) whilst the Sulphur Crested Cockatoo (*Cacatua galerita*) and Black-faced Cuckoo Shrike (*Coracina novaehollandiae*) were observed flying over the canopy.

Forest areas in the proposed Vineyard car park area consisted of intact forest canopy with moderate leaf litter, fallen trees, rocks and a patchy shrub layer. This area was observed being used by species of bird including the Superb Fairy Wren (*Malurus cyaneus*), Yellow Thornbill (*Acanthiza nana*), Willie Wagtail and species of reptile including the Grass Sun Skink. Older trees may provide nesting opportunities for open country and generalist species of bird and roosting habitat for microchiropteran bats.

4.3.3 Regrowth vegetation and cleared areas

Regrowth and cleared areas occur in the site of the proposed new Vineyard Station and associated rail line. These areas provided limited resources for fauna, consisting of low, open ground cover and scattered remnant trees or young regrowth. Little structural complexity was observed in these areas. These areas would support generalist species of bird and reptile.

Older trees may provide nesting opportunities for open country and generalist species of bird and roosting habitat for microchiropteran bats. Two mature *E. fibrosa* trees were recorded in the proposed Vineyard Station area (refer Photo 4-6), these had small hollows (10 centimetres in diameter) as well as deep, vertical fissures within the stem and branches (refer Photo 4-7).

Photo 4-6 **Mature *Eucalyptus fibrosa* in the proposed location for the new Vineyard Station**

Photo 4-7 **Fissure in a mature *Eucalyptus fibrosa* in the proposed location of the new Vineyard Station**

4.3.4 Aquatic habitats

Aquatic habitats occur as small, open drainage ditches generally within track-side gullies and other temporarily inundated depressions, as well as stormwater channels. These habitats do not, however, contain significant riparian vegetation and/or are overgrown with introduced weed species such as *Salix babylonica, Sida rhombifolia*, and *Galium aparine*. *Typha* spp. are also common. In general, these areas are highly modified through weed invasion, rubbish dumping and drainage control works, including concreting, and are invaded by introduced vegetation, however, common species of amphibian such as the Common Eastern Froglet (*Crinia signifera*) and the Spotted Grass Frog (*Limnodynastes tasmaniensis*) occur in ephemeral drainage ditches and drainage lines. These habitats would not provide significant habitat for aquatic species as these would be classed as minimal fish habitat (class 3 (Fairfull and Witheridge 2003), and one of the drainage lines crossing the rail corridor (near Princess Street, Riverstone) has been classified as a Category 2 riparian corridor (GCC 2008) based on the classification of the Riparian Corridor Management Study (Department of Infrastructure Planning and Natural Resources 2004). This means that it provides basic habitat and preserves the natural features of a watercourse (not necessarily linking key destinations).

5. Threatened biodiversity

5.1 Threatened ecological communities

Threatened ecological communities are listed as Critically Endangered, Endangered or Vulnerable under Schedule 1, Part 3 of the TSC Act, and/or under the EPBC Act.

Most remnant native vegetation on the Cumberland Plain, and all native vegetation within the study area, is considered to be part of a Threatened ecological community. This includes regrowth vegetation that is likely to achieve a near natural structure, or is a seral stage (an intermediate stage found in ecological succession) towards that structure, which can regenerate naturally once threats, such as weeds, grazing and mowing/slashing, are controlled (Department of the Environment and Heritage 2000; NSW National Parks and Wildlife Service 2004a).

A total of 13 Threatened ecological communities listed under the TSC Act and/or the EPBC Act have been recorded and/or are predicted to occur within the locality and along the rail alignment (Table 5-1). Three were recorded as occurring in the study area (refer Table 5-1).

Table 5-1 Threatened ecological communities known or predicted to occur in the project locality

Threatened ecological community	Legislative status		Occurrence within the study area	Occurs within non-certified areas
	TSC Act[1]	EPBC Act[2]		
Agnes Banks Woodland	E	-	No, characteristic species not recorded.	No, not present within the study area
Blue Gum High Forest	E	CE	No, characteristic species not recorded.	No, not present within the study area
Castlereagh Swamp Woodland	E	-	No, characteristic species not recorded.	No, not present within the study area
Cooks River Castlereagh Ironbark Forest	E	-	No, occurs adjacent to the site, north-east of Vineyard Station.	No, not present within the study area
Cumberland Plain Woodland	E	E	Yes. Present along the rail alignment, occurring in seven small patches close to Quakers Hill and Schofields stations.	No, restricted to certified areas of the north west growth centre
Elderslie Banksia Scrub Forest	E	-	No, characteristic species not recorded.	No, not present within the study area
River-flat Eucalypt Forest on Coastal Floodplains	E		Yes. Occurs as five patches in the rail corridor and adjoining lands, where it is restricted to an unnamed tributary of Eastern Creek north of Quakers Hill Station.	No, restricted to certified areas of the north west growth centre

Threatened ecological community	Legislative status		Occurrence within the study area	Occurs within non-certified areas
	TSC Act[1]	EPBC Act[2]		
Shale Gravel Transition Forest	E	-	Yes. Occurs in the northern part of the alignment close to Riverstone.	No, restricted to certified areas of the north west growth centre
Shale/Sandstone Transition Forest	E	E	No. Characteristic tree species not recorded.	No, not present within the study area
Swamp Oak Floodplain Forest	E	-	No, characteristic species not recorded.	No, not present within the study area
Swamp Sclerophyll Forest on Coastal Floodplains	E	-	No, characteristic species not recorded.	No, not present within the study area
Sydney Turpentine-Ironbark Forest	E	CE	No. Characteristic tree species not recorded.	No, not present within the study area
Western Sydney Dry Rainforest	E	-	No, characteristic species not recorded.	No, not present within the study area

Note: 1- Listed as Endangered (E) under the TSC Act

2- Listed as Endangered (E) or Critically Endangered (CE) under the EPBC Act.

5.2 Threatened populations

Endangered populations are listed under Schedule 1 Part 2 of the TSC Act. The proposal is within the Blacktown LGA. One Endangered population is listed as occurring within this LGA: *Marsdenia viridiflora* ssp. *viridiflora*. This species occurs in vine thicket and open shale woodland. It has not been recorded at the site and is unlikely to occur based on the small area of potential habitat, the poor condition of these areas and the lack of individuals despite the level of survey undertaken (see Appendix B for habitat requirements).

5.3 Threatened flora

A total of 41 threatened species of plant listed under the TSC Act and/or the EPBC Act have been recorded previously, or are predicted to occur, within the local area (see Appendix B for habitat requirements and likelihood of occurrence).

Two threatened species of plant were recorded at the site (Figure 4-1):

- *Pultenaea parviflora* (refer Photo 5-1 and Photo 5-2), listed as Endangered under the TSC Act and Vulnerable under the EPBC Act
- *Grevillea juniperina* subsp *juniperina* listed as Vulnerable under the TSC Act.

A total of 66 *Pultenaea parviflora* plants have been recorded within the study area, including:

- 12 mature plants in the existing rail corridor easement, to the west of the existing rail line and south of the proposed new Vineyard Station
- 54 plants (17 seedlings and 37 mature) between the rail corridor and Riverstone Parade (between Norwood Road and Camberwell Road).

A total of two specimens of *Grevillea juniperina* subsp *juniperina* have been recorded within the study area, including:

- one mature plant within a cleared paddock approximately 10 metres west of the rail corridor south of New Schofields Station
- one mature plant to the north of Bandon Road outside of the proposed subject site.

Although not recorded, the site also provides potential habitat for a further three threatened species of plant (Appendix B):

- *Dillwynia tenuifolia* — listed as Vulnerable under both the TSC Act and the EPBC Act
- *Micromyrtus minutiflora* — listed as Endangered under the TSC Act and as Vulnerable under the EPBC Act
- *Pimelea spicata* — listed as Endangered under both the TSC Act and the EPBC Act.

Photo 5-1 *Pultenaea parviflora*

Photo 5-2 ***Pultenaea parviflora*** **(in centre of photo) and its habitat within the rail corridor**

5.4 Threatened fauna

Forty-six threatened species of animal have been recorded previously, or have the potential to occur, in the project locality. All are listed under the TSC Act and 15 are listed also under the EPBC Act (Table 5-2).

Table 5-2 Threatened species recorded or predicted to occur in the project locality

Group	TSC Act	EPBC Act	Total threatened
Invertebrates	2	-	2
Frogs	6	5	6
Birds	21	3	21
Mammals	15	6	15
Reptiles	2	1	2
TOTAL	**46**	**15**	**46**

Details of species requirements and their likelihood of occurrence are provided in Appendix C. No Threatened animal was recorded in the study area. However, the study area may provide potential habitat for the following 13 threatened species of animal:

- Cumberland Plain Land Snail (*Meridolum corneovirens*)
- Glossy Black-cockatoo (*Calyptorhynchus lathami*)
- Painted Honeyeater (*Grantiella picta*)
- Square tailed kite (*Lophoictinia isura*)
- Speckled Warbler (Pyrrholaemus sagittatus)

- Diamond Firetail (Stagonopleura guttata)
- Black Chinned Honeyeater (*Melithreptus gularis gulari*)
- Powerful Owl (*Ninox strenua*)
- Eastern Freetail bat (*Mormopterus norfolkensis*)
- Yellow Sheathtail Bat (*Saccolaimus flaviventris*)
- Greater Broad-nosed Bat (*Scoteanax rueppellii*)
- Large-eared Pied Bat (*Chalinolobus dwyeri*)
- Grey-headed Flying Fox (*Pteropus poliocephalus*).

5.5 Migratory species

Migratory species are protected under international agreements to which Australia is a signatory, including the *Japan Australia Migratory Bird Agreement* (JAMBA), the *China Australia Migratory Bird Agreement* (CAMBA), the *Republic of Korea Australia Migratory Bird Agreement* (ROKAMBA) and the *Bonn Convention on the Conservation of Migratory Species of Wild Animals*. Migratory species are considered NES matters and are protected under the EPBC Act.

Thirteen migratory bird species have been predicted to occur within the project locality, based on the Department of the Environment, Water, Heritage and the Arts Protected Matters Search Tool (Appendix C). None were recorded within the study area.

Although migratory species may utilise habitats within the study area such as farm dams or drainage lines or on a temporary basis, the study area is not considered important habitat for any migratory species in that it does not contain:

- habitat utilised by a migratory species occasionally or periodically within a region that supports an ecologically significant proportion of the population of the species
- habitat utilised by a migratory species which is at the limit of the species' range
- habitat within an area where the species is declining.

As such, impacts of the proposal on migratory species are not considered further.

5.6 Critical habitat

Critical habitat is listed under both the TSC Act and EPBC Act and a register is maintained at both the State and Federal level. Critical habitat is the whole or any part, or parts, of an area, or areas, of land comprising the habitat of an endangered species, an endangered population or an endangered ecological community that is critical to the survival of the species, population or ecological community as listed in the schedules of the Acts.

No critical habitats are listed at either state or federal level as occurring in the study area or local area.

6. Impacts

This chapter details the possible impacts of the Project on biodiversity values of the area. Mitigation measures are detailed in Chapter 7 and an assessment of the significance of the impacts is detailed in Chapter 8.

The Project would result in a range of direct impacts on existing biodiversity in the Project footprint of the new rail line and associated infrastructure, as well as potential indirect impacts on biodiversity in the surrounding landscape.

A number of these threats are listed as key threatening processes (KTP) under Schedule 3 of the TSC Act and also under the EPBC Act.

Potential impacts of the Project on biodiversity include:

- clearing of native vegetation — listed as a KTP
- disturbance of habitats, including:
  - removal of dead wood and dead trees — listed as a KTP
  - loss of hollow-bearing trees — listed as a KTP
  - bushrock removal — listed as a KTP
- invasion and establishment of weeds — invasion by specific weeds listed as KTP (exotic perennial grasses, exotic vines and scramblers, scotch broom, bitou bush and bone seed, *Lantana camara*)
- invasion and establishment of pest species — some pest species listed as KTP (including rabbits and foxes)
- alteration to the natural flow regimes of rivers, streams, floodplains and wetlands — listed as a KTP
- fragmentation and barrier effects
- edge effects
- noise and dust
- cumulative impacts.

These impacts are discussed in more detail below.

6.1 Clearing of native vegetation

The Project would include clearing of native vegetation. Clearing is known to affect threatened species of flora and fauna and is recognised as a KTP under the following final determination titles:

- clearing of native vegetation — under the TSC Act
- land clearance — under the EPBC Act.

Native vegetation that would be removed in the rail corridor and adjacent areas impacted by proposed rail design and associated infrastructure consists of patches of regrowth and remnant vegetation. Most of the regrowth vegetation is highly disturbed and the areas of remnant vegetation to be removed are relatively small.

Potential loss of vegetation due to clearing associated with the Project is shown by vegetation community in Table 6-1 and Figure 4-1.

Table 6-1 Potential loss of vegetation

Vegetation community	TSC Act[1]	EPBC Act[2]	Total (ha)
River-flat Eucalypt Forest on Coastal Floodplains	E	-	1.47
Cumberland Plain Woodland	E	E	1.34
Shale Gravel Transition Forest*	E	-	1.71*
Derived Grassland (previously shale gravel transition forest)	-	-	0.08
Total vegetation			**4.60**

Notes: 1- Listed as Endangered (E) under the TSC Act
2- Listed as Endangered (E) under the EPBC Act
* includes 0.44 hectares for Phase 1 of the new Vineyard Station car park and 0.53 hectares for Phase 2

Vineyard Station

An area of good condition Shale Gravel Transition Forest (listed as endangered under the TSC Act) occurs in the proposed site for the new Vineyard Station car park. This area has been identified as a core habitat (conservation significance assessment class, NSW National Parks and Wildlife Service 2002a), however, no threatened species were recorded in this area.

The car park is proposed to be built in two phases, Phase 1 would require the removal of 0.44 hectares of vegetation and Phase 2 0.53 hectares. The exact timing of the construction of the Phase 2 car park is unknown and would be subject to further investigations of biodiversity impacts and alternative locations.

Clearing for the proposed new Vineyard Station car park would result in the fragmentation of good condition Shale Gravel Transition Forest, however it is unlikely to significantly increase the fragmentation of habitat in this area given it is already partially fragmented by existing roads and tracks.

Weed invasion is likely to impact the areas associated with the proposed car park and bus interchange. As stated previously, the vegetation in this area is in good to moderate condition and further weed invasion resulting from disturbance to this area is likely to threaten the viability of the native vegetation. Appropriate mitigation measures are required to be implemented during construction to avoid an increase in weed invasion in this area. Application of mitigation measures as shown in Section 7 of this assessment during construction will therefore significantly reduce any likelihood of weed invasion in the proposed Vineyard Station car park area. Weed invasion is further discussed for the Project in Section 6.3.

6.2 Disturbance of fauna habitats

Clearing of native vegetation would result in the removal of fauna habitat elements including direct and indirect feeding resources, dead trees (fallen and standing), tree hollows (often limited to small hollows only suitable for woodland birds), bush rock, dead wood (fallen) and leaf litter layer. Fauna use these habitat elements for shelter, to hide from predators, to find food, to avoid extreme weather conditions and for breeding.

Fauna habitat elements (such as fallen timber, tree hollows, riparian habitats) are limited resources, especially in modified landscapes, and are generally slow to develop following disturbance. Many threatened species of animal are dependent on one or more of these habitat elements to complete their life cycle (e.g. tree hollows for breeding).

The study area provides limited fauna resources: bush rock is uncommon, and due to past disturbance and clearing, the majority of the trees in the study area are young and there is little dead wood. Only two significant hollow-bearing trees were recorded and few scattered dead trees and fallen dead branches would be removed as part of the Project across the study area. These are located within the proposed Vineyard Station area and Department of Defence lands opposite Manorhouse Boulevard.

6.3 Invasion and establishment of weeds

One hundred and four species of weed were recorded, corresponding to 44% of the species recorded in the study area. This included seventeen species listed as noxious weeds in the Hawkesbury River County Council noxious weed control area (includes Blacktown local government area). Of these, three are also listed as weeds of national significance (Section 4.2.1).

Construction activities have the potential to disperse weeds into areas of remnant vegetation where they do not currently occur. The most likely causes of weed dispersal associated with the Project would include earthworks, movement of soil and attachment of seed (and other propagules) to vehicles and machinery. This may, in turn, reduce the condition of vegetation communities and habitat quality for Threatened species.

The study area has a high level of weed invasion, with the majority of the vegetation in the study area dominated by weeds, particularly in the central and southern sections. The northern section of the study area, in the vicinity of the new Vineyard Station and including the proposed car park and bus interchange, is in good to moderate condition and further weed invasion in this area may threaten the viability of the native vegetation. However, the Project is unlikely to result in increased weed invasion in the study area provided appropriate mitigation measures are implemented during construction (see Section 7).

6.4 Invasion and establishment of pest species

Thirteen of the Key Threatening Processes under the TSC Act and EPBC Act relate to invasion and establishment, predation by, competition from, and change in habitat resulting from feral animal species. Three of these Key Threatening Processes relate to the following feral animal species identified in the study area:

- predation by the European Red Fox, *Vulpes vulpes*
- predation by the Feral Cat, *Felis catus*
- competition and grazing by the feral European Rabbit.

These pest species are likely to be already established in the study area and most likely already have an effect on native fauna populations in the locality.

6.5 Alteration to the natural flow regimes of rivers, streams, floodplains and wetlands

The Project involves the crossing of a number of small drainage lines and the reconstruction of a number of drainage culverts. Construction may increase the velocity of stream flows. However, the impacts of increased velocity (such as erosion) are likely to be minimal as a majority of the drainage lines have concreted sides and have been artificially created.

6.6 Habitat fragmentation and barrier effects

Habitat fragmentation is the division of a single area of habitat into two or more smaller areas, with the occurrence of a new habitat type in the area between the fragments. This new dividing habitat type is often artificial and inhospitable to the species remaining within the fragments (Department of Environment and Heritage 2005). Although the newly created habitat is generally used by some species, those species are usually generalists and are often considered aggressive (Department of Environment and Heritage 2005), further decreasing population levels of the species remaining in the fragments. In addition to the loss of total habitat area, the process of fragmentation can affect species within the newly created fragments in a number of ways, including barrier effects, genetic isolation and edge effects. The degree to which these potential impacts affect the flora and fauna within the newly created fragments depends on a number of variables, including distance between the fragments, local environmental conditions, the species present and mitigation measures. Some of the potential impacts are summarised below:

- **Barrier effects**: Barrier effects occur where particular species are either unable or unwilling to move between suitable areas of fragmented habitat. This could result in either a complete halt to movement or reduced level of movement between fragments.
- **Genetic isolation**: Genetic isolation occurs where individuals from a population in one fragment are unable to interbreed with individuals from populations in adjoining fragments. Genetic isolation can lead to inbreeding and genetic drift problems for populations isolated within a fragment.

Cleared areas present a barrier to the movement of some species such as woodland dependant birds (Bennett & Radford 2004; Radford & Bennett 2007).

The Project occurs in a largely cleared landscape that is already fragmented by roads, rail, industrial and urban development and agricultural lands. The proposed rail duplication and associated stations and bus interchange are adjacent to the existing rail line and would not significantly increase fragmentation or barrier effects.

As discussed in Section 6.1, clearing for the proposed new Vineyard Station car park would potentially result in the fragmentation of good condition Shale Gravel Transition Forest; however, the Project is unlikely to significantly increase the fragmentation of habitat in this area as it is already partially fragmented by existing roads and tracks.

6.7 Edge effects

Edge effects are zones of changed environmental conditions (i.e. altered light levels, wind speed and/or temperature) occurring along the edges of habitat fragments. These new environmental conditions can promote the growth of different vegetation types (including weeds) and allow invasion by pest animals specialising in edge habitats. Edge zones can be subject to higher levels of predation by introduced mammalian predators and native avian predators. Edge effects have mainly been recorded adjacent to roads and at distances greater than 1,000 metres from a road surface (Forman & Alexander 1998) However, in a comparison of edge effects in a variety of different habitat types, it was estimated that, on average, edge effects generally occur up to 50 metres away from the road edge (Bali 2000).

Vegetation and habitats in the study area are already highly fragmented as a result of past clearing, roads, rail, industrial and urban development, electricity easements and agricultural activities. Additional clearing is unlikely to result in any areas being introduced to new edge effects.

6.8 Noise and dust

During construction there will be increased noise and dust in the local area for a short period of time. This may cause disturbance to fauna in the area, although given the proximity of the Project to the existing rail line and roads, it is expected that the impact of this would be minor. Dust may also have impacts to flora, particularly if construction undertaken during fry period. Impacts of dust to flora are likely to be minor dur to localised and short term nature of these impacts.

6.9 Cumulative impacts

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

The Project is located in a moderately developed landscape dominated by rural-residential and industrial development in which the remaining areas of remnant vegetation and associated habitat are fragmented. The Project footprint occurs adjacent to existing rail and road infrastructure.

This existing landscape is expected to change significantly over the next 25 to 30 years with the development of the North West Growth Centre. The Project is located at the centre of the growth centre, adjacent to the planned precincts of Schofields, Schofields West, Alex Avenue, Riverstone, Riverstone West and Vineyard. Based on preliminary planning information from the Growth Centres Commission, the North West Growth Centre will be developed to include a mix of major centres, town and village centres, local neighbourhoods and industrial/employment land. Development of the North West Growth Centre is likely to have a considerable impact on biodiversity in the Project locality, therefore, the biodiversity impacts associated with the Project should also be considered in the context of the broader development expected in the North West Growth Centre over the next 25 to 30 years. Biodiversity certification has considered the North West Growth Centre as a whole and as

such the cumulative impacts have been assessed and offsets on a regional basis have been calculated for this region through planning mechanisms. As such the impacts are considered at a larger scale and take into consideration the cumulative impacts of projects within the region.

7. Mitigation measures

A general principle of environmental management is to, in order of preference:

- avoid environmental impacts
- reduce impacts
- mitigate the impacts
- as a last resort, once the above options have been investigated, compensate for the residual impacts.

7.1 Management of the mitigation process

As part of the detailed design and prior to construction, detailed flora and fauna mitigation measures would be developed and presented as part of the environmental management plans relating to the construction and operation of the Project. The plans, particularly the environmental management plan (CEMP) would address:

- staff/contractor inductions
- weed control
- fencing of sensitive/no-go areas flora
- pre-clearing surveys and fauna salvage/translocation
- rehabilitation and restitution of adjoining habitat
- pest management
- monitoring impacts to Threatened biodiversity, particularly *Pultenaea parviflora.*

The plans would include clear objectives and actions for the Project including:

- minimise human interferences to flora and fauna
- minimise vegetation clearing/disturbance
- minimise impact to threatened species and communities
- minimise impacts to aquatic habitats and species
- flora and fauna monitoring undertaken at regular intervals.

7.2 Vegetation and habitat loss

Disturbance to areas of native vegetation and habitat would be unavoidable during the construction process. In order to avoid further disturbance to areas outside of those already identified, sensitive areas would be clearly identified during the construction process as ‘no-go’ areas. These would be marked on maps, as well as on the ground using high visibility fencing (such as barrier mesh). No direct disturbance would occur in these areas, including vehicle access.

A trained ecologist would accompany clearing crews in order to ensure disturbance is minimised. The adoption of these measures would limit the extent of habitat disturbance, prevent soil compacting and damage to trees.

Where possible, revegetation of areas disturbed by construction of the Project would be undertaken, thereby increasing the habitat value and visual amenity of the areas. Revegetation of the areas would include:

- collection of seed
- planting of a range of locally occurring native shrubs, trees and groundcover plants
- including logs, dead trees and stumps in the landscaping/rehabilitation works
- increasing the overall vegetation cover within the study area
- incorporating existing natural vegetation where possible
- focusing on riparian vegetation to protect waterways
- designing and constructing waterway crossings and creek diversions following the *Guidelines for Design of Fish Friendly Waterway Crossings* (Fairfull & Witheridge 2003) in consultation with DPI (Fisheries) and DNR
- maintaining plantings through a landscaping agreement will be for set period after construction then handed over
- reducing the extent of exotic weeds through weed management measures.

7.3 Weed management

Construction activities have the potential to disperse weeds into areas of remnant vegetation where they do not currently occur. The most likely causes of weed dispersal associated with the Project would include earthworks, movement of soil and attachment of seed (and other propagules) to vehicles and machinery. The northern section of the study area, in the vicinity of the new Vineyard Station and including the proposed car park and bus interchange, is in good to moderate condition and further weed invasion in this area may threaten the viability of the native vegetation. A weed management plan would be developed as part of the CEMP and would outline measures, including:

- identification of noxious weeds, weeds of national significance (WONS) and environmental weeds occurring in the study area with information on known dispersal mechanism and requirements to prevent weed spread
- for weed control focussing on noxious species, weeds of national significance and environmental weeds
- for management of soil stockpiles to prevent the establishment of weeds
- to prevent spread of weeds through construction activities, particularly in the northern section of the Project. For example, plant will be cleaned prior to construction activities in the northern section of the project.

7.4 Mortality

Where clearing of vegetation and fauna habitats would take place, clearing protocols would be put in place, including preparing an inventory of significant habitat trees and hollows to be removed, and checking hollow-bearing trees for the presence of bird nests and arboreal animals, such as possums, gliders, parrots and bats, prior to felling or pushing. Animals found to be occupying trees would be safely removed before the clearing of trees. A qualified ecologist would relocate removed animals locally into nearby habitat. Nest boxes or salvaged tree hollows would be provided in the nearby woodland for each relocated animal.

7.5 Erosion and pollution

During construction, erosion would be minimised by staging works and not disturbing areas until needed as well as undertaking progressive restoration and revegetation in the two construction stages. Erosion will be further minimised by retaining remaining vegetation cover, wherever possible, and by managing storm water flows to reduce flow rates and erosion potential. Following construction, erosion control would be achieved by reinstating the natural creek contours and providing bank stability, for example through the use of jute matting incorporating sterile seeds (e.g. millet) to provide stability. Native species would be planted in these areas using tube stock.

Potential contaminants would not be stored in or in proximity to natural waterways; refuelling of machinery would similarly be undertaken at least 30 metres from natural waterways in clearly marked designated areas that are designed to contain spills and leaks. Chemical spill kits would be readily available and accessible to construction workers and all hazardous materials spills and leaks would be reported to site managers. All appropriate spill containment measures would be adopted and incorporated into the CEMP.

7.6 Monitoring

The project will impact biodiversity within the region, including the Threatened *Pultenaea parviflora*, Shale Gravel Transition Forest, River-flat eucalypt forest and Cumberland Plain Woodland. Monitoring and reporting of the outcomes of management and mitigation actions is important in ensuring their effectiveness. Details of management actions undertaken will be recorded along with any subsequent outcomes. As part of the management plans a detailed program would be developed to monitor impacts on threatened species and communities and determine the effectiveness of mitigation measures, such as habitat rehabilitation. Monitoring would continue for at least three years post-construction. Results of the monitoring would feed back to the management plans in an adaptive manner.

7.7 Summary of mitigation measures

A summary of mitigation measures for the Project is provided in Table 7-1. This table details the stage of the Project where the measures would be implemented — detailed design, construction and/or operation.

Table 7-1 Summary of mitigation measures

Mitigation measure	Detailed Design	Construction	Operation
▪ If possible, refine the location of the new Vineyard Station and associated development (car park and bus interchange) and identify ancillary areas in light of biological conservation significance, knowledge and design constraints including the presence of *Pultenaea parviflora* and Shale Gravel Transition Forest.	Y		
▪ Prepare and implement flora and fauna management measures under CEMP. This plan would outline: general impact mitigation; staff/contractor inductions; pre-clearing surveys and fauna salvage/translocation; rehabilitation and restitution of adjoining habitat; weed control; pest management; monitoring.	Y	Y	Y

Mitigation measure	Detailed Design	Construction	Operation
▪ Provide environmental inductions to all staff prior to commencing work.		Y	
▪ Provide for designated areas in cleared and degraded land for equipment laydown and stockpiling of resources to minimise the overall impact of the construction and avoid unnecessary vegetation and habitat removal.		Y	
▪ A trained ecologist will pre-clear the disturbance areas prior to construction activities commencing in order to: ‣ mark the limits of clearing and install temporary fencing in sensitive areas (including Endangered Ecological Communities, *Grevillea juniperina* subsp *juniperina* and *Pultenaea parviflora* population) to avoid unnecessary vegetation and habitat removal ‣ implement pre-clearing surveys for fauna.		Y	
▪ Clean equipment, vehicles, clothing and shoes prior to commencing work in the northern section of study area (north of Victoria Street) and in areas adjacent to remnant vegetation.		Y	
▪ Clearing crews would be accompanied by a trained ecologist in order to ensure disturbance is minimised.		Y	
▪ Replace riparian vegetation disturbed by the Project with appropriate endemic species to maintain creek / drainage line bank stability.		Y	Y
▪ Ongoing management and monitoring of weed invasion.		Y	Y
▪ Implement an adaptive monitoring program for at least three years post-construction, focussing on: ‣ *Pultenaea parviflora* population ‣ *Grevillea juniperina* subsp *juniperina* ‣ Endangered ecological communities ‣ rehabilitated areas.		Y	Y

7.8 Offsets

All native vegetation to be cleared occurs within the North West Growth Centres biodiversity certified area. No offset area is required under State legislation as a result of this biodiversity certification.

8. Impact assessment

8.1 EPBC assessment of significance

The study area supports the following threatened biodiversity listed under the EPBC Act:

- Cumberland Plain Woodland — listed as an Endangered Ecological Community
- *Pultenaea parviflora* — listed as Vulnerable.

Commonwealth significance assessments were undertaken for Cumberland Plain Woodland and *Pultenaea parviflora* (refer Appendix D).

Cumberland Plain Woodland to be cleared for the Project occurs as seven small, degraded, isolated patches within the rail corridor and adjoining lands (totalling 1.34 hectares). Based on the most recent comprehensive vegetation mapping of the region (undertaken in 2002), there was approximately 9,760 hectares of this community remaining (NSW National Parks and Wildlife Service 2002a). Since this broadscale mapping was completed, the area of Cumberland Plain vegetation communities is likely to have decreased. Remnants of Cumberland Plain Woodland within the study area were in poor condition and generally consisted of isolated trees. Most patches lacked a shrub layer and the ground cover was generally dominated by introduced grasses, herbs and vines.

Seven small patches of this community occur within the rail easement and adjoining lands that would potentially be removed as a result of the project (totalling 1.34 hectares):

- three small patches to south of Schofield Station
- four patches to north of Quakers Hill Station (Figure 4-1).

The removal of 1.34 hectares of degraded and fragmented vegetation is not considered a significant area, and would be unlikely to reduce the extent of the community, such that its long-term survival is threatened. Within the site, this community was in poor condition and subject to ongoing threats including weed invasion. These patches are mapped as 'other remnant vegetation' under the *Final Native Vegetation Mapping of the Cumberland Plain, Western Sydney* (NSW National Parks and Wildlife Service 2002a, 2002b) and are unlikely to be critical to the long-term survival of this community. The significance assessment for Cumberland Plain Woodland concluded that the Project was unlikely to have a significant impact.

The Project would result in the loss of 47 *Pultenaea parviflora* plants and 260 square metres of its habitat. Approximately 200 square metres of habitat would be retained. Populations of this species vary from 10 to more than 5,000 plants (NSW National Parks and Wildlife Service 2004b), and as such, this population is considered to be relatively small. Due to the small size, high level of weed invasion, isolated and disturbed nature of the habitat and number of populations in the vicinity (including in conservation reserves), the removal of this habitat and part of the population is unlikely to have a significant impact on this species or its recovery. Whilst the Project is unlikely to have a significant impact, the cumulative loss of habitat and plants as a result of other projects may further threaten this species. The primary aim of environmental management is to avoid environmental impacts, and as such, it is recommended that the final layout and landscaping of the bus interchange avoid or minimise impacts to this threatened species and aim to retain this species within the site. Where

avoidance is not possible, impacts should be mitigated. Translocation of plants is not a suitable alternative to in-situ conservation and due to the risks of failure and possible impacts to donor sites should only be considered as a last resort when all other options have been examined (Vallee *et al.* 2004). Once the design has been finalised and impacts minimised as far as possible, the potential of translocation of plants could be examined in consultation with the Department of Environment and Climate Change.

Two other threatened species may occur within the study area (Grey-headed Flying Fox and Large-eared Pied Bat), however, given the minimal extent of clearing, and lack of specialised habitat resources, these species are unlikely to use or be dependant on resources within the subject site.

While migratory species of bird may potentially fly over the site, the site would not be classed as an 'important habitat' as defined under the EPBC Act *Policy Statement 1.1 Significant Impact Guidelines* (Department of the Environment and Heritage 2006), in that the site does not contain habitat used by a migratory species occasionally or periodically within a region that:

- supports an ecologically significant proportion of the population of the species
- includes habitat used by a migratory species that is at the limit of the species range
- includes habitat in an area where the species is declining.

As such, it is unlikely that the proposed development would significantly affect migratory species.

8.2 Assessment under TSC Act

The majority of the study area occurs within the North West Growth Centre and biodiversity certification has been granted over this area under Section 126G of the TSC Act. Biodiversity certification identifies areas within the growth centres as either certified or non-certified (refer Figure 1-1).

8.2.1 Non-certified areas

Non-certified areas generally correspond with areas of higher conservation value (such as known locations of Threatened species habitat), and development in non-certified areas requires threatened species assessments under the TSC Act. However, non-certified areas within the study area do not provide habitat for threatened biodiversity because:

- these areas do not contain native vegetation communities
- these areas are highly disturbed and modified, consisting of mown grass and weeds
- targeted surveys failed to detect threatened flora species
- these areas do not contain specialised habitat resources for fauna such as tree hollows, caves or suitable water bodies.

Assessment for threatened species is, therefore, not required under the TSC Act within the non-certified areas investigated as part of this proposal.

8.2.2 Certified areas

Certified areas are generally those that are likely to be of lower conservation value. However, within the study area, all threatened biodiversity occurs within certified areas, namely:

- all occurrences of Endangered ecological communities (Cumberland Plain Woodland, Shale Gravel Transition Forest and River-Flat Eucalypt Forest on Coastal Floodplains)
- all occurrences of *Pultenaea parviflora* and *Grevillea juniperina* subsp *juniperina*
- all potential habitat for threatened species.

However, a precautionary approach was taken and significance assessments were conducted for threatened communities and species that had a moderate or greater likelihood of occurring within the study area in accordance with *Guidelines for Threatened Species Assessment* (Department of Environment and Conservation 2005a) (see Chapter 9).

9. Biodiversity assessment

The biodiversity assessment was undertaken in accordance with the *Draft Guidelines for Threatened Species Assessment* (Department of Environment and Conservation 2005, (the 'Draft Guidelines')). The objective of the assessment process under the Draft Guidelines is to provide information to enable decision makers to ensure that developments deliver a number of environmental outcomes including the requirement to maintain or improve biodiversity values (i.e. there is no net impact on threatened species or native vegetation).

All threatened biodiversity and their habitats occur within areas accredited with biodiversity certification under the State Environmental Planning Policy (Sydney Region Growth Centres) 2006 (the 'Growth Centres SEPP') (see Section 8.2). The main practical effect of certification is that it removes the need to undertake threatened species assessments for developments or activities within the area subject to certification.

A precautionary approach was taken and for the areas subject to biodiversity certification, and significance assessments following the heads of consideration as outlined in the draft *Guidelines for Threatened Species Assessment* (Department of Environment and Conservation 2005a) were conducted for threatened communities and species that had a moderate or greater likelihood of occurring within the study area. The significance assessments are presented in Appendix E and summarised below in Table 9-1.

Table 9-1 Threatened ecological communities and species for which significance assessments were conducted

Species or community	Conservation Status		Likely to be significantly affected
	State [1]	National [2]	
Cumberland Plain Woodland	E	E	No. Only a small amount (1.34 ha) of this community which is in poor condition and highly fragmented will be cleared.
River-Flat Eucalypt Forest on Coastal Floodplains of the NSW North Coast, Sydney Basin and South East Corner bioregions	E	-	No. Only five small patches (1.47 ha) will be cleared and these are highly fragmented and degraded.
Shale Gravel Transition Forest	E	-	No. A total of 1.71 ha would be cleared including: ▪ within the proposed bus interchange – a narrow strip (up to 3 metres wide),of degraded vegetation. This area contains *Pultenaea parviflora* ▪ the proposed Vineyard Station and rail alignment – young regrowth vegetation with past grazing. The area is disturbed and highly fragmented ▪ within the proposed Vineyard Station car park – good condition vegetation with a high diversity of native ground cover species

Species or community	Conservation Status		Likely to be significantly affected
	State [1]	National [2]	
Dillwynia tenuifolia	V	V	No. No individuals recorded and potential habitat for this species is disturbed and highly fragmented.
Micromyrtus minutiflora	E	-	No. No individuals recorded and potential habitat for this species is degraded and highly fragmented.
Pimelia spicata	E	E	No. No individuals recorded and potential habitat for this species is disturbed and highly fragmented.
Pultenaea parviflora	E	V	No. The Project would include loss of 47 *Pultenaea parviflora* plants which is considered to be a small population. Approximately 0.02ha of habitat for this species would be retained. Due to the small population size, high weed invasion, isolation and disturbed nature of the habitat and number of populations in the vicinity (including within conservation reserves) the removal of this habitat and part of the population is unlikely to have a significant impact on this species or its recovery.
Grevillea juniperina subsp *juniperina*	V	-	No. Two *Grevillea juniperina* subsp *juniperina* plants were recorded within the study area, one of which, would be removed as a result of the Project. This is unlikely to significantly affect the species or interfere with its recovery as it occurs as an isolated individual within a cleared paddock.
Cumberland Plain Land Snail (*Meridolum corneovirens*)	E	-	No. No evidence of the Cumberland Plain Land Snail was detected within the study area. Impacts to Cumberland Plain Land Snail within the study area will result in loss of 3.05 ha of potential habitat; however this is fragmented, in poor condition and is subject to ongoing threats such as weed invasion.
Grey-headed Flying-fox (*Pteropus poliocephalus*)	V	V	No. The Project will result in the removal of 3.05 ha of Grey-Headed Flying-fox foraging habitat within the study area, and given the high mobility of the species this is unlikely to represent a significant reduction in the availability of foraging resources within the species' range. The Project will not affect or disrupt and Grey-headed Flying-fox roosting habitat (camps).

Species or community	Conservation Status		Likely to be significantly affected
	State [1]	National [2]	
Yellow-bellied Sheathtail Bat (*Saccolaimus flaviventris*)	V	-	No. The Project will result in the removal of approximately 4.60 ha of Yellow-bellied Sheathtail Bat habitat within the study area, including the removal of two significant hollow-bearing trees. This area is relatively small in relation to similar habitats available in the local area.
Large-eared Pied Bat (*Chalinolobus dweryi*)	V	V	No. The Project will result in the removal of approximately 4.60 ha of Large-eared Pied Bat habitat within the study area, including the removal of two significant hollow-bearing trees. This area is relatively small in relation to similar habitats available in the local area.
Eastern Freetail-bat (*Mormopterus norfolkensis*)	V	-	No. The Project will result in the removal of approximately 4.60 ha of Eastern Freetail Bat habitat within the study area, including the removal of two significant hollow-bearing trees. However this area is relatively small in relation to similar habitats available in the local area, and this is unlikely to represent a significant reduction in the availability of foraging resources within the species' range.
Greater Broad-nosed Bat (*Scoteanax rueppellii*)	V	-	No. The Project will result in the removal of approximately 4.60 ha of Greater Broad-nosed Bat habitat within the study area, including the removal of two significant hollow-bearing trees. However this area is relatively small in relation to similar habitats available in the local area.
Glossy Black-cockatoo (*Calyptorhynchus lathami*)	V	-	No. The Project will remove approximately 1.47 ha of habitat suitable for foraging by the Glossy Black-cockatoo. This area is relatively small, poor in condition and fragmented in relation to similar habitats available in the local area. Important habitat resources such as nesting hollows/trees are not abundant in the area, nor will they be removed by the proposal.
Powerful Owl (*Ninox strenua*)	V	-	No. The Project will remove approximately 4.60 ha of potential foraging habitat for the Powerful Owl, however this area is relatively small in relation to similar habitats available in the local area. Important habitat resources such as nesting hollows are not present within the study area.

Species or community	Conservation Status		Likely to be significantly affected
	State [1]	National [2]	
Square-tailed Kite (*Lophoictinia isura*)	V	-	No. The Project will remove approximately 4.60 ha of habitat suitable for foraging by the Square-tailed Kite, this area is relatively small in relation to larger areas of potential foraging habitat within the locality which would provide habitat for a wider variety of passerine bird species which are the primary prey of the Square-tailed Kite. No nests consistent with the Square-tailed Kite were identified within the study area, nor will they be removed by the Project.
Speckled warbler (*Prryholaemus sagittatus*)	V	-	No. The Project will remove approximately 4.60 ha of habitat suitable for foraging by the Speckled Warbler, this area is relatively small and of poor quality compared to larger areas of similar habitat available in the local area.
Diamond Firetail (*Stagonopleura guttata*)	V	-	No. The Project will remove approximately 4.60 ha of habitat suitable for foraging by the Diamond Firetail, this area is relatively small and of poor quality compared to larger areas of similar habitat available in the local area.
Black-chinned Honeyeater (*Melithreptus gularis gularis*)	V	-	No. The Project will remove approximately 4.60 ha of habitat suitable for foraging by the Black-chinned Honeyeater, this area is relatively small and of poor quality compared to larger areas of similar habitat available in the local area.
Painted Honeyeater (*Grantiella picta*)	V	-	No. The Project will remove approximately 4.60 ha of habitat suitable for foraging the Painted Honeyeater, this area is relatively small and of poor quality compared to larger areas of similar habitat available in the local area. There was no evidence of Mistletoe infestations within the study area.

Notes:

1. State conservation status: V= Vulnerable, E = Endangered, (*Threatened Species Conservation Act 1995* and *Fisheries Management Act 1994*).

2. National conservation status: V = Vulnerable, E = Endangered (*Environment Protection and Biodiversity Conservation Act 1999*).

The heads of consideration did not identify any significant impacts to Threatened biodiversity likely to result from the Project. However, offsets determined in accordance with the biodiversity certification order for the State Environmental Planning Policy (Sydney Regional Growth Centres) 2006 will be implemented as part of the development of the NWGC.

10. Conclusions

The proposed rail duplication and associated infrastructure, with the exception of the new Vineyard Station car park, occurs within disturbed and previously cleared areas in poor to moderate condition.

The Project would include clearing of up to 4.60 hectares of native vegetation, including the following endangered ecological communities:

- River-flat Eucalypt Forest on Coastal Floodplains — 1.47 hectares
- Cumberland Plain Woodland — 1.34 hectares
- Shale Gravel Transition Forest — 1.71 hectares
- Derived grassland (previously shale gravel transition forest) — 0.08 hectares.

Significance assessments were undertaken for threatened biodiversity in the study area listed under the EPBC Act*:* Cumberland Plain Woodland; and *Pultenaea parviflora.* These assessments concluded that the Project is unlikely to have a significant impact due to the small size, high level of weed invasion, isolated and disturbed nature of the *Pultenaea parviflora* habitat and areas of Cumberland Plain Woodland in the subject site were degraded, isolated and small (totalling 1.34 hectares).

The majority of the study area occurs in the North West Growth Centre and biodiversity certification has been granted over this area. All threatened biodiversity listed under the TSC Act, and its habitat, in the study area occurs in certified areas. As such these areas should require no further threatened species assessment under the TSC Act. However, following legal advice, a precautionary approach was taken and significance assessments were undertaken for threatened species that had a moderate or greater likelihood of occurring within the study area. These followed the heads of consideration as detailed in the draft *Guidelines for Threatened Species Assessment* (Department of Environment and Conservation 2005a). The heads of consideration did not identify any significant impacts to Threatened biodiversity likely to result from the Project. However, offsets determined in accordance with the biodiversity certification order for the State Environmental Planning Policy (Sydney Regional Growth Centres 2006) will be implemented as part of the development of the NWGC.

In general the impacts to threatened biodiversity listed under the TSC Act would be minimal, with threatened species avoided and the clearing required consisting predominantly of previously cleared and highly disturbed vegetation. The exception to this is the proposed new Vineyard Station car park area. This area contains good condition Shale Gravel Transition Forest (listed as endangered under the TSC Act) — this area has been identified as a core habitat (conservation significance assessment class, NSW National Parks and Wildlife Service 2002a), however, no threatened species were recorded in this area. The heads of consideration undertaken for this endangered ecological community concluded that the Project was unlikely to significantly increase fragmentation, disturb habitat connectivity, or increase the existing disturbance regimes within the study area to the extent that the Project would have a significant impact on this community or its recovery.

However, the site provides potential habitat for a range of species and it is recommended that the final location of the new Vineyard Station car park, including Phase 2, and bus interchange be configured to minimise impacts to threatened biodiversity as much as possible in consultation with GCC, for example by considering other locations for the Phase 2 car park such as the west of the rail corridor where the vegetation has been previously cleared and grazed.

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