

## 6. Environmental assessment

### 6.1 Biodiversity

This section addresses the potential terrestrial and aquatic biodiversity impacts associated with the proposal and details the management measures proposed to mitigate these impacts.

#### 6.1.1 Methodology

The methodology for the terrestrial and aquatic flora and fauna assessment is described below.

##### ***Background research***

A desktop biodiversity assessment was carried out and included a review of relevant and publicly available literature and background information to identify threatened and migratory species, endangered populations and threatened ecological communities (TECs) (or their habitats) that had previously been recorded within, or near to, the proposal area. The following searches were conducted:

- Office of Environment and Heritage (OEH) Atlas of NSW Wildlife Database within a 10 kilometre radius of the proposal, in February 2018 and June 2019
- NSW Department of Primary Industries (DPI) Fisheries Fish Records Viewer, in February 2018
- Department of the Environment and Energy (DoEE) Protected Matters Search Tool (PMST) for known/predicted EPBC Act listed TECs within a 10 kilometre radius of the proposal, in February 2018
- Commonwealth critical habitat register, in February 2018
- The federal Bureau of Meteorology's Atlas of Groundwater Dependent Ecosystems (GDE), in February 2018
- DoEE directory of important wetlands, in February 2018
- DPI database for aquatic TECs, in February 2018
- DPI Key Fish Habitat mapping, in February 2018.

The following additional resources were also reviewed:

- OEH vegetation information system (VIS) database, in June 2019
- The Vegetation of the Central Hunter Valley, NSW (Peake 2006)
- Greater Hunter Native Vegetation Mapping (Sivertsen et al. 2011)
- State Vegetation Type Map: Upper Hunter
- Digital imagery (aerial photography) of the proposal area
- Atlas of NSW Wildlife Database within a 10 kilometre radius of the proposal, in September 2019
- DoEE PMST search in September 2019.

##### ***Habitat assessment***

A desktop habitat assessment of likelihood of occurrence of threatened species was undertaken using the results of the background research and field surveys. The likelihood of occurrence of these species and TECs within the proposal area was assessed based on the categories provided in Table 6-1.

Table 6-1: Likelihood of occurrence criteria

Likelihood	Criteria
Recorded	Threatened species was observed during the current survey
High	It is highly likely that a threatened species inhabits the proposal area and is dependent on identified suitable habitat
Moderate	Potential habitat is present in the proposal area.
Low	It is unlikely that threatened species inhabits the study area and has not been recorded recently in the locality (10km).
None	Suitable habitat is absent from the proposal area.

The likelihood of occurrence table is located in Appendix B of Appendix I.

### **Field survey**

#### **Vegetation surveys**

Field surveys of the proposal area were conducted using a combination of vegetation integrity plots, rapid vegetation assessment points, random meander and targeted searches for threatened species was used to survey the proposal area and to map vegetation communities.

All vascular plants recorded or collected within vegetation integrity plots and rapid vegetation assessment points were identified using keys and Harden (1992, 1993, 2000 and 2002). Updated taxonomy has been derived from PlantNET (Botanic Gardens Trust 2019).

#### **Habitat surveys**

Habitat surveys were undertaken where all trees were visually inspected from the ground to identify possible hollows. A search for evidence of owls was also carried out during the hollow-bearing tree (HBT) survey.

#### **Fauna surveys**

A range of fauna surveys were undertaken across the proposal area, including:

- Diurnal bird surveys
- Call-playback
- Spotlighting
- Motion-sensing cameras
- Ultrasonic recordings
- Dusk watch for bats
- Harp trapping.

#### **Aquatic surveys**

The habitat value of the Hunter River was assessed to inform characterisation of habitat sensitivity and waterway classification. An aquatic habitat assessment was carried out at the proposed bridge crossing location of the Hunter River. The assessment included a visual inspection of the river at the crossing site and 100 metres upstream and downstream, to identify the aquatic habitat features present.

Field survey methods and effort are summarised in Table 6-2.

Table 6-2: Targeted species survey details

Method	Target species	Effort per site	Replication	Total survey effort
Diurnal bird survey	regent honeyeater, grey-crowned babbler, speckled warbler, little lorikeet, little eagle, scarlet robin, hooded robin, painted honeyeater, white-bellied sea-eagle, varied sittella, brown treecreeper, spotted harrier, flame robin, diamond firetail	20 minutes with 2 observers	7 sites	4.6 person-hours
Call-playback	masked owl, powerful owl, bush stone-curlew	30-minute listen/broadcast/search event per site with 2 observers in suitable habitat	2 sites per night on 8 nights	16 call-playback sessions over 8 separate nights
Spotlighting	squirrel glider, brush-tailed phascogale, masked owl, powerful owl, bush stone-curlew, grey-headed flying-fox	At least 1 hour with 2 observers, combination of walking and driving	8 nights	16 person-hours
Motion-sensing cameras (arboreal)	squirrel glider, brush-tailed phascogale	15 nights at 5 sites; 27 nights at 3 sites	8 sites	156 trap nights
Motion-sensing cameras (ground)	spotted-tailed quoll	15 nights at 2 sites; 27 nights at 2 sites	4 sites	84 trap nights
Ultrasonic recording	eastern cave bat, yellow-bellied sheath-tail-bat, Corben's long-eared bat, southern myotis, eastern coastal freetail-bat, large bentwing-bat, little bentwing-bat, eastern false pipistrelle	Units were set to record from 2000 to 0500 hrs each night. For each site call data was analysed for two nights.	5 sites	10 trap nights
Dusk watch for bats		1 observer at each entrance for 30 mins before, and 1 hour after dusk	2 sites	2 dusk watches
Harp trapping		1 trap over culvert during emergence	1 site	1 emergence survey
Meandering transects	Threatened flora, including <i>Cymbidium canaliculatum</i>	N/A	N/A	ELA: 16, 29, 30 October and 6, 7 December 2018 Umwelt: 21, 24, 25, 27 June 2019

## 6.1.2 Existing environment

### *Plant community types*

The total extent of plant community types recorded in the proposal area based on verified and regional vegetation mapping is shown in Table 6-3 below.

Table 6-3 Extent of plant community types within the proposal area

Plant community type (PCT)	Condition	Area (ha) in proposal area	Area (ha) in impact area
<b>Verified Vegetation Mapping</b>			
1598 Forest Red Gum Grassy Open Forest on Floodplains of the Lower Hunter	Moderate/Good	0.47	-
1598 Forest Red Gum Grassy Open Forest on Floodplains of the Lower Hunter	Derived Native Grassland (DNG)	0.22	-
1604 Narrow-leaved Ironbark - Grey Box - Spotted Gum Shrub - Grass Woodland of the Central and Lower Hunter	Moderate/Good	19.45	5.34
1604 Narrow-leaved Ironbark - Grey Box - Spotted Gum Shrub - Grass Woodland of the Central and Lower Hunter	Thinned Canopy	11.46	6.35
1604 Narrow-leaved Ironbark - Grey Box - Spotted Gum Shrub - Grass Woodland of the Central and Lower Hunter	DNG	50.16	14.21
1604 Narrow-leaved Ironbark - Grey Box - Spotted Gum Shrub - Grass Woodland of the Central and Lower Hunter	African Olive Infestation	1.14	-
-	Exotic Grassland	0.84	0.33
-	Cleared Land, Dam and Swamp Oak Plantings	2.84	1.50
<b>Total</b>		<b>86.57</b>	<b>27.73</b>
<b>Regional Vegetation Mapping</b>			
42 River Red Gum / River Oak riparian woodland wetland in the Hunter Valley	-	3.83	1.22
1600 Spotted Gum - Red Ironbark - Narrow-leaved Ironbark - Grey Box shrub-grass open forest of the lower Hunter	-	4.36	2.21
1600 Spotted Gum - Red Ironbark - Narrow-leaved Ironbark - Grey Box shrub-grass open forest of the lower Hunter	DNG	2.44	2.44
1601 Spotted Gum - Narrow-leaved Ironbark-Red Ironbark shrub - grass open forest of the central and lower Hunter	-	4.15	0.08

Plant community type (PCT)	Condition	Area (ha) in proposal area	Area (ha) in impact area
1603 Narrow-leaved Ironbark - Bull Oak - Grey Box shrub - grass open forest of the central and lower Hunter	-	0.15	-
1604 Narrow-leaved Ironbark - Grey Box - Spotted Gum shrub - grass woodland of the central and lower Hunter	-	0.02	-
1731 Swamp Oak - Weeping Grass grassy riparian forest of the Hunter Valley	-	-	0.08
Non-native	-	156.11	75.92
<b>Total</b>		<b>171.14</b>	<b>81.95</b>
<b>Overall Total</b>		<b>257.73</b>	<b>109.69</b>

### ***Threatened ecological communities***

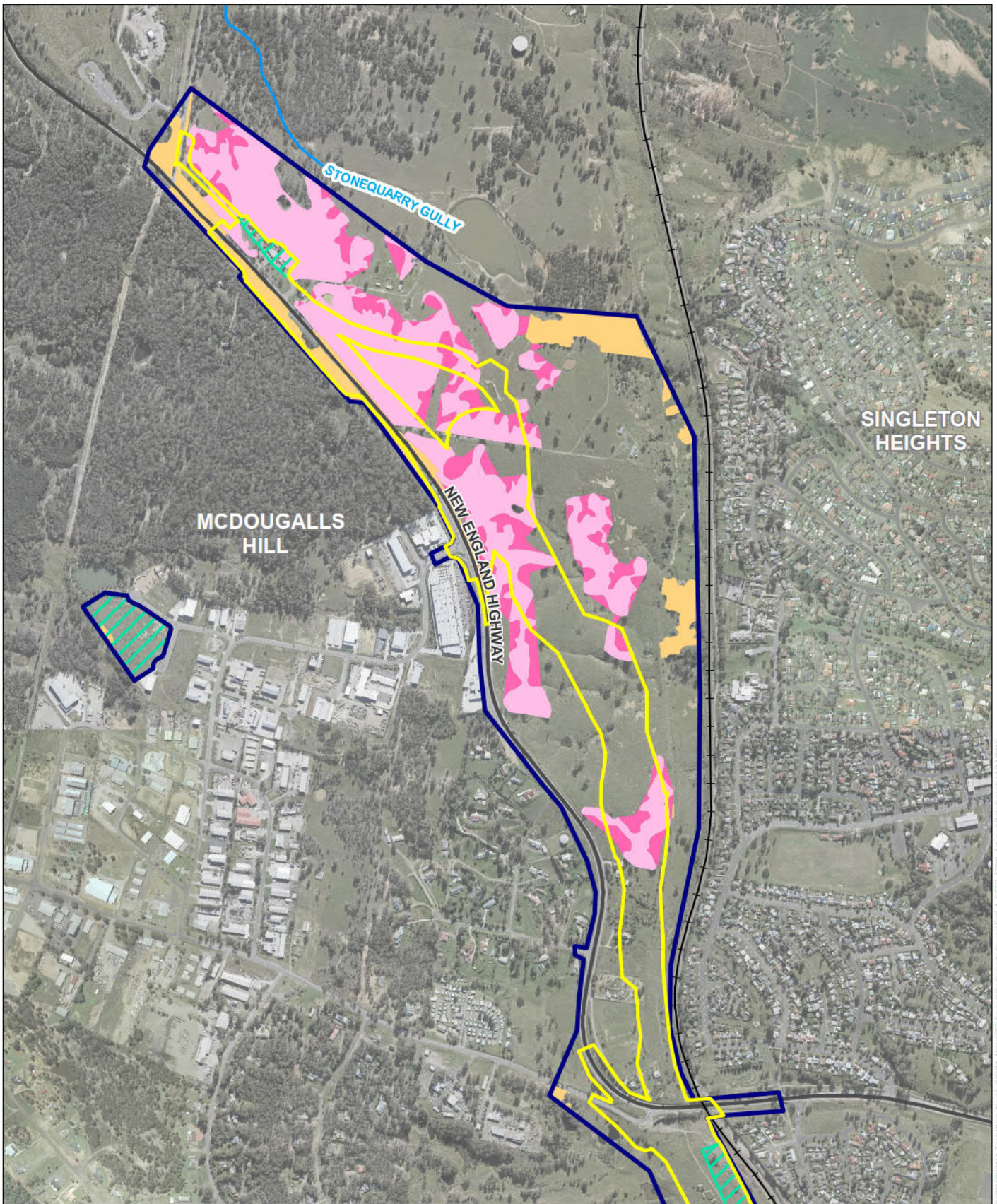
The threatened ecological communities listed under the BC Act and EPBC Act that were mapped to be within the proposal area are listed below and shown on Figure 6-1 and Figure 6-2:

- Hunter Lowland Redgum Forest in the Sydney Basin and NSW North Coast Bioregions EEC (BC Act)
- Hunter Floodplain Red Gum Woodland in the NSW North Coast and Sydney Basin Bioregions EEC (BC Act)
- Central Hunter Ironbark – Spotted Gum – Grey Box Forest in the NSW North Coast and Sydney Basin Bioregions EEC (BC Act)
- Central Hunter Grey Box—Ironbark Woodland in the New South Wales North Coast and Sydney Basin Bioregions EEC (BC Act)
- Central Hunter Valley Eucalypt Forest and Woodland CEEC (EPBC Act).

### ***Threatened flora species and populations***

Three individual river red gum (*Eucalyptus camaldulensis*) were recorded within the proposal area. These individuals are part an endangered flora population (BC Act).





**FIG. 6-1 Critically endangered ecological communities (EPBC Act)**



**Legend**

**Proposal features**

- Proposal area
- Disturbance area
- Construction ancillary facilities

**Other features**

- State roads
- Watercourse
- Main North railway line

**CEEC**

- Central Hunter Valley Eucalypt Forest and Woodland CEEC
- Central Hunter Valley Eucalypt Forest and Woodland CEEC - Derived Native Grassland Form
- PCT's likely to be equivalent to the Central Hunter Valley Eucalypt Forest and Woodland CEEC
- Central Hunter Valley Eucalypt Forest and Woodland CEEC

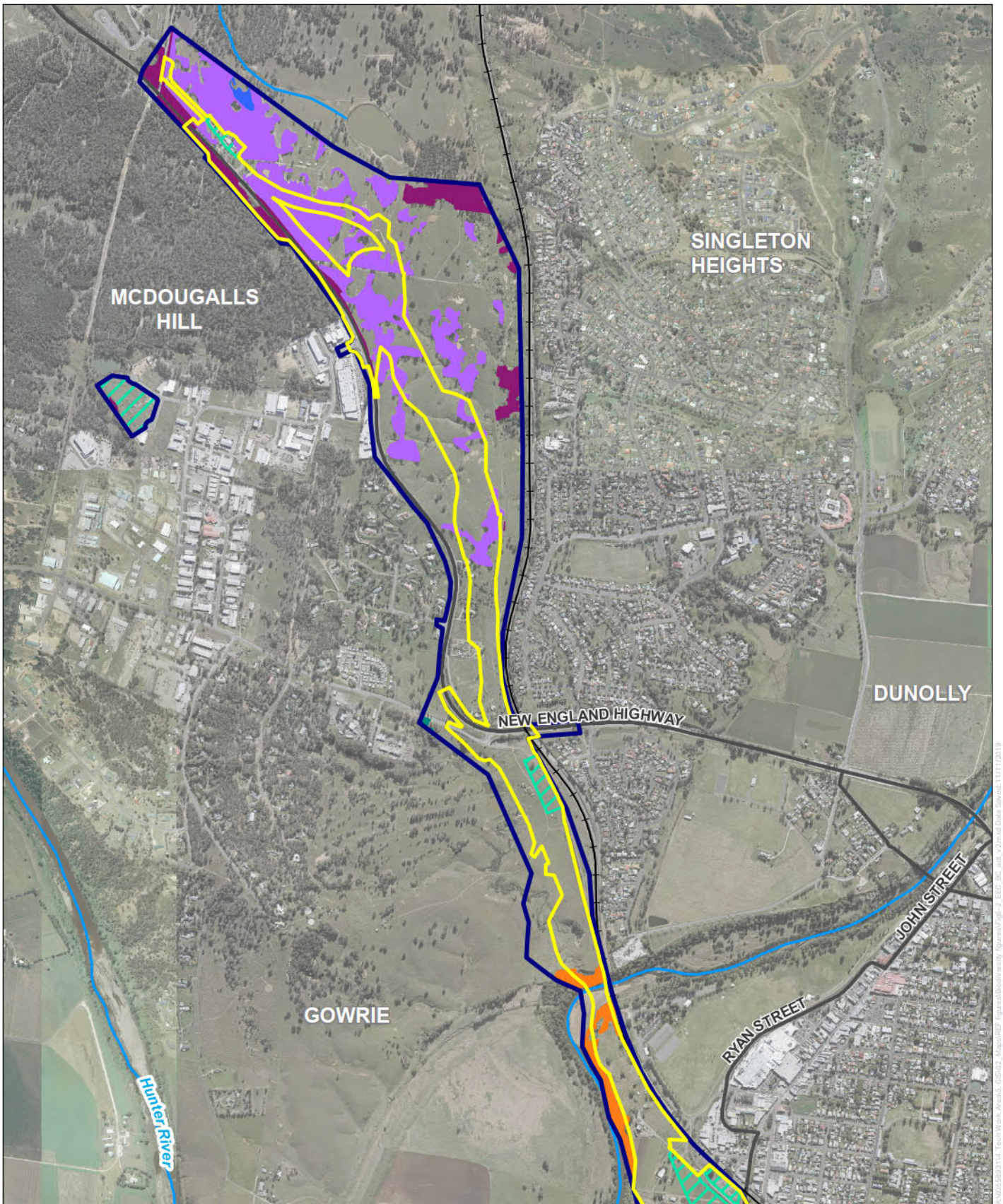
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**FIG. 6-2 Endangered ecological communities (BC Act)**



**Legend**

- Proposal features**
- Proposal area
- Disturbance area
- Construction ancillary facilities
- Other features**
- State roads
- Watercourse
- Main North railway line
- EEC**
- Central Hunter Grey Box—Ironbark Woodland in the New South Wales North Coast and Sydney Basin Bioregions EEC
- Central Hunter Ironbark – Spotted Gum – Grey Box Forest in the NSW North Coast and Sydney Basin Bioregions EEC
- Hunter Floodplain Red Gum Woodland in the NSW North Coast and Sydney Basin Bioregions EEC
- PCT's likely equivalent to BC Act TEC's
- Central Hunter Ironbark-Spotted Gum-Grey Box Forest in the NSW North Coast and Sydney Basin Bioregions EEC
- Hunter Lowland Redgum Forest in the Sydney Basin and NSW North Coast Bioregions EEC

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### Threatened fauna species and populations

Nine threatened fauna species were recorded as present, and four threatened species as potentially present, during fauna surveys (refer to Table 6-4).

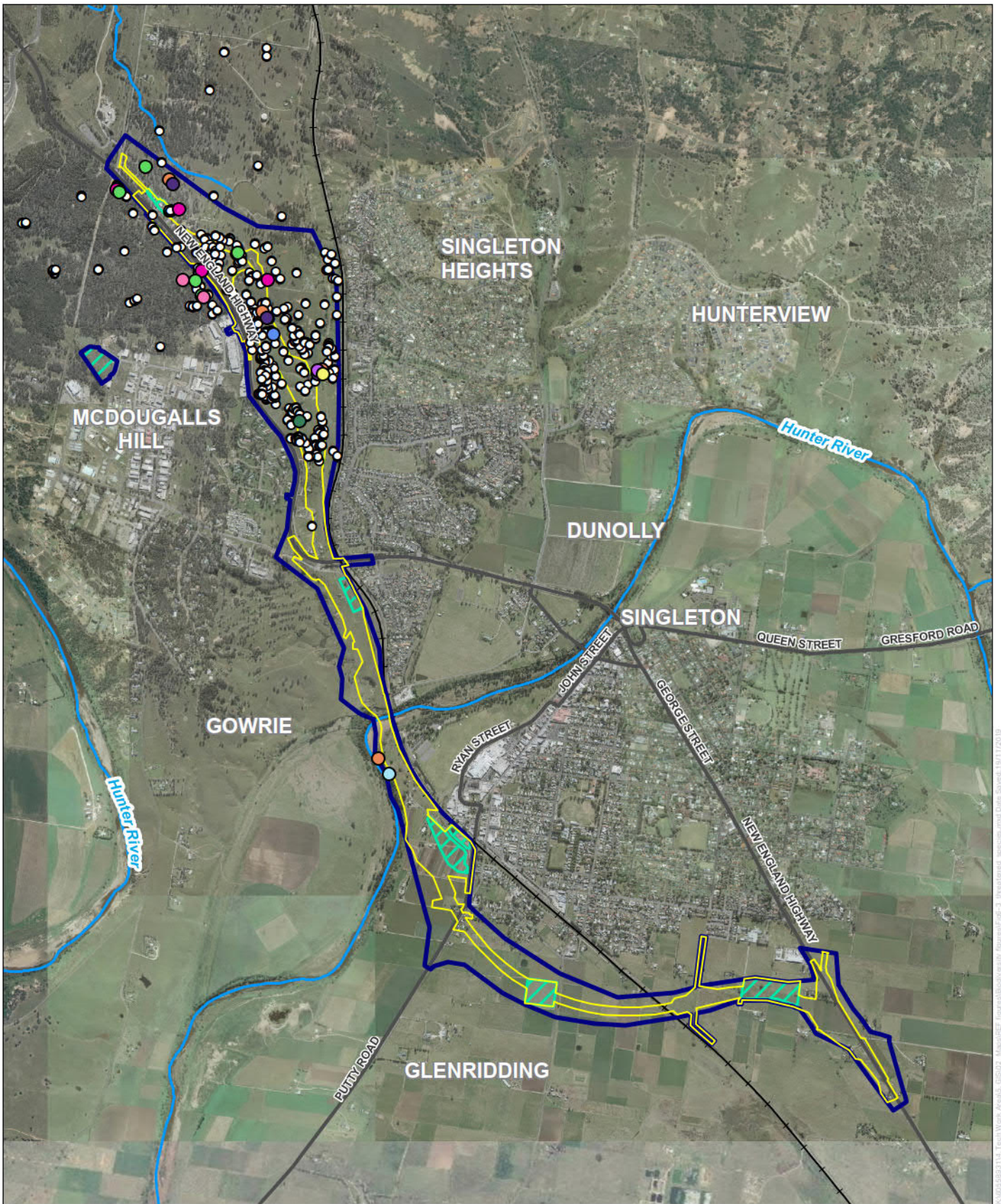
Table 6-4 Habitat assessment and survey results

Scientific name	Common Name	Status	
		BC Act	EPBC Act
<b>Birds</b>			
<i>Hieraaetus morphnoides</i>	little eagle	V	-
<i>Pomatostomus temporalis</i>	grey-crowned babbler	V	-
<i>Tyto novaehollandiae</i>	masked owl	V	-
<b>Mammals</b>			
<i>Falsistrellus tasmaniensis</i>	eastern false pipistrelle	V	-
<i>Micronomus norfolkensis</i>	eastern coastal free-tailed bat	V	-
<i>Miniopterus australis</i>	little bent-winged bat	V	-
<i>Miniopterus oriana oceanensis</i>	large bent-winged bat	V	-
<i>Myotis macropus</i>	southern myotis	V	-
<i>Petaurus norfolcensis</i>	squirrel glider	V	-
<i>Phascogale tapoatafa</i>	brush-tailed phascogale	V	-
<i>Pteropus poliocephalus</i>	grey-headed flying-fox	V	V
<i>Scoteanax rueppellii</i>	greater broad-nosed bat	V	-
<i>Vespadelus troughtoni</i>	eastern cave bat	V	-

Habitat for threatened species which occur in the proposal area are shown below in Figure 6-3 and include:

- A total of 32.1 hectares of native vegetation, comprised of 16.0 hectares of grassland habitat and 14.5 hectares of woodland and forest vegetation that contains 239 hollow-bearing trees
- One known and five potential microbat roost sites in existing sandstone block culverts
- Key fish habitat in the Hunter River.





**FIG. 6-3 Threatened fauna species and key habitat features**



**Legend**

- Proposal features**
- Proposal area
- Disturbance area
- Construction ancillary facilities
- Other features**
- State roads
- Watercourse
- Main North railway line
- Habitat feature**
- Hollow-bearing tree

- Threatened species**
- Brush-tailed Phascogale
- Eastern Bentwing Bat
- Eastern Coastal Free-tailed Bat
- Grey-crowned Babbler
- Little Bentwing Bat
- Little Eagle
- Masked Owl (potential record)
- Eucalyptus camaldulensis population in the Hunter catchment
- Microbat Roost
- Southern Myotis
- Squirrel Glider

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### ***Aquatic results***

The Hunter River is mapped as key fish habitat under the NSW DPI Key Fish Habitat mapping for the Singleton LGA, and forms part of the known distribution for the threatened southern purple-spotted gudgeon (*Mogurnda adspersa*). The nearest known population of the southern purple-spotted gudgeon occurs about 20 kilometres north of Singleton in a tributary of Glennies Creek.

Within the proposal area the Hunter River has been classified as Type 1 highly sensitive fish habitat and Class 1 major key fish habitat area (refer to Appendix I for clarification).

### ***Critical habitat and Areas of Outstanding Biodiversity Values***

No critical habitat listed under the FM Act was identified within the proposal area and no declared Areas of Outstanding Biodiversity Values listed under the BC Act occur within the proposal area.

### ***Wildlife connectivity corridors***

Wildlife corridors are largely limited to those occurring along the Hunter River and remnant vegetation north of the Hunter River between the New England Highway and the Main North railway line. An area of remnant vegetation about 250 hectares in size occurs to the west of the New England Highway between Maison Dieu Road and Rixs Creek.

### ***Groundwater dependent ecosystem***

A review of the Bureau of Meteorology's Atlas of Groundwater Dependent Ecosystems identified the Hunter River as a high potential aquatic Groundwater Dependent Ecosystem (GDE). It is considered to be reliant on groundwater in addition to rainfall in the Hunter River channel.

## **6.1.3 Potential impacts**

### ***Construction***

#### **Native vegetation communities**

During construction, 32.1 hectares of native vegetation including 91 hollow-bearing trees would require removal, consisting of:

- Around 1.22 hectares of Hunter Floodplain Red Gum Woodland in the NSW North Coast and Sydney Basin Bioregions EEC (BC Act)
- Around 13.98 hectares of Central Hunter Ironbark – Spotted Gum – Grey Box Forest in the NSW North Coast and Sydney Basin Bioregions EEC (BC Act)
- Around 16.89 hectares of Central Hunter Valley Eucalypt Forest and Woodland CEEC (EPBC Act).

#### **Threatened flora**

Based on field survey results, three individual River red gum (*Eucalyptus camaldulensis*) which are part of the endangered flora populations in the Hunter catchment have been recorded within the study area but outside of the proposal disturbance area.



## Fauna habitat

Native vegetation provides potential foraging and/or breeding habitat for numerous threatened fauna species. The proposal would result in the removal of 91 hollow-bearing trees, many of which contain multiple hollows and seven of which are stags. Together, these hollow-bearing trees include:

- 183 hollows less than five centimetres wide (80 trees)
- 147 hollows five to 10 centimetres wide (67 trees)
- 60 hollows 10 to 20 centimetres wide (45 trees)
- 13 hollows 20 to 30 centimetres wide (12 trees)
- Three hollows greater than 30 centimetres wide (three trees).

Six culverts which provide potential habitat for microbats, including the Southern myotis (*Myotis macropus*) which was recorded during surveys, occur within the proposal area. Four of these would not be disturbed by the proposal, however two of the culverts could be indirectly impacted by the work through increased noise, light and vibration impacts.

## Aquatic

Construction of the temporary instream structures in the Hunter River has the potential to result in alteration of fish passage during construction. The proposal includes construction of five piers and abutments, including four piers on the southern bank of the river and one pier in the river channel.

Temporary access ramps, crane pads, sheet piling and a temporary rock platform in the river would impact on aquatic habitat values during construction. The rock platform would not block the main river channel. The banks would be protected by geotextile material with rock overlay, or similar, to protect them from tracked equipment including cranes required to access the instream platform to lift the bridge girders into place. A silt curtain would be installed around the rock platform to protect water quality. The platform would be designed to ensure that flow of the main river channel and fish passage is maintained even during low flow periods.

During the proposal there would be the potential for impacts on water quality through fuel spills and leaks from machinery, and from runoff of soils and materials into the waterway. If not controlled, this could lead to a degraded aquatic environment, increased turbidity and contamination of the waterway which could reduce the habitat quality for aquatic species. The implementation of the mitigation measures listed in Section 6.1.4 would reduce the likelihood for an incident to occur.

The proposal would not degrade native riparian vegetation.

## Key threatening processes

A threatening process is considered a key threatening process (KTP) under the BC Act if:

- (a) It adversely affects threatened species or ecological communities, or
- (b) It could cause species or ecological communities that are not threatened to become threatened.

There are four known and six potential KTPs under the BC Act, and one known KTP under the FM Act relevant to the proposal (see Table 6-5).

Table 6-5 KTPs relevant to the proposal

Key threatening process	Type of Threat	Relevance to proposal
<b>Known</b>		
Clearing of native vegetation (BC Act)	Habitat loss/change	During construction, 32.1 hectares of native vegetation would require removal.
Loss of hollow-bearing trees (BC Act)	Habitat loss/change	The proposal would result in the direct removal of 91 hollow-bearing trees.
Removal of dead wood and dead trees (BC Act)	Habitat loss/change	The proposal would result in the removal of dead wood and dead trees as part of vegetation clearing.
Alteration to the natural flow regimes of rivers and streams and their floodplains and wetlands (BC Act)	Habitat loss/change	The proposal would result in temporary instream structures in the Hunter River.
Installation and operation of instream structures and other mechanism that alter natural flow regimes of rivers and streams (FM Act)	Habitat change	The proposal would result in temporary instream structures in the Hunter River.
<b>Potential</b>		
Invasion of native plant communities by exotic perennial grasses (BC Act)	Weed	Exotic perennial grasses are present in the proposal area, particularly along roadsides. Weed management required to avoid/reduce impact of this KTP.
Invasion of native plant communities by African olive <i>Olea europaea</i> subsp. <i>cuspidata</i> (Wall. ex G. Don) Cif. (BC Act)	Weed	African Olive is present in proposal area. Weed management required to avoid/reduce impact of this KTP.
<b>Low Potential</b>		
Competition and grazing by the feral European rabbit (BC Act)	Pest animal	European rabbit is present in the proposal area.
Predation and hybridisation by Feral Dogs, <i>Canis lupus familiaris</i> (BC Act)	Pest animal	Feral dogs are potentially present in the proposal area.
Predation by feral cats (BC Act)	Pest animal	Feral cats are present in the proposal area.
Predation by the European red fox (BC Act)	Pest animal	European red fox is present in the proposal area.



## Noise, light and vibration

The proposal would result in an increase of noise, light and vibration impacts during the construction and operation phases. These impacts have the potential to adversely affect fauna species through disturbance of roosting and foraging behaviour and reducing the occupancy of areas of suitable habitat. As the proposal area occurs adjacent to the urban centres of Singleton and Singleton Heights, which are already subject to noise, light and vibration impacts from the adjacent railway and the existing New England Highway and Main North railway line, it is not expected that the proposal would significantly affect the behaviour of fauna in the surrounding area during construction.

### Operation

Long-term effects associated with the proposal include fragmentation of fauna habitat and resulting loss of wildlife connectivity corridors in the area. Invasion and spread of weeds, pests and pathogens, and changes to surface hydrology may occur as a result of the changed landscape.

Fish passage would be altered during construction however, upon completion, the bridge across the Hunter River is not expected to alter natural flows or block passage for any aquatic species or foraging micro-bats. Following the completion of bridge construction, the rock platform would be removed, and stabilised.

The proposal would result in an overall change to a small percentage of each of the relevant catchments of the first and second order watercourses within the proposal area, north of the Gowrie Gates, and is likely to have minor impacts. The third order watercourse that flows into the Hunter River from the north would be diverted as part of the proposal.

### Assessments of Significance

Assessments of Significance were carried out for 19 threatened fauna species, one endangered flora population, and two TECs listed under the BC Act, and five threatened fauna species and one TEC and migratory species under the EPBC Act. An Assessment of Significance under the FM Act was also carried out for the southern purple-spotted gudgeon (*Mogurnda adspersa*). These assessments found that the proposal would likely significantly impact the Central Hunter Valley Eucalypt Forest and Woodland CEEC (EPBC Act). No other threatened species, populations or ecological communities known or predicted to occur are likely to be significantly impacted by the proposal.

The Assessments of Significance for threatened species can be found in Appendix F of Appendix I.

### Conclusion on significance of impacts

The proposal is not likely to significantly impact threatened species or ecological communities or their habitats, within the meaning of the *Biodiversity Conservation Act 2016* or *Fisheries Management Act 1994* and therefore a Species Impact Statement or Biodiversity Development Assessment Report is not required.

The proposal is likely to significantly impact threatened species, ecological communities or migratory species, within the meaning of the *Environment Protection and Biodiversity Conservation Act 1999*.

Where a significant impact is likely to threatened species, ecological communities or migratory species within the meaning of the *Environment Protection and Biodiversity Conservation Act 1999*:

Is there a real chance that the activity threatens the long-term survival of nationally listed biodiversity matters?	No
Has the consistency of the activity with relevant recovery plans, threat abatement plans, conservation advices and guidelines provided by the Australian Government been considered?	Yes
Can suitable offsets be secured?	Yes

## 6.1.4 Safeguards and management measures

Mitigation measures provided in Table 6-6 would be implemented to minimise potential impacts biodiversity.

Table 6-6: Summary of mitigation measures to minimise impacts to biodiversity

Impact	Environmental safeguards	Responsibility	Timing
Biodiversity	<p>A Flora and Fauna Management Plan will be prepared and implemented as part of the CEMP. It will address terrestrial and aquatic matters and will include, but not necessarily be limited to:</p> <p>(a) plans for the construction site and adjoining area showing native vegetation, flora and fauna habitat, threatened species and threatened ecological communities;</p> <p>(b) plans showing areas to be cleared and areas to be protected, including exclusion zones and protected habitat features (e.g. hollow-bearing trees), and areas for rehabilitation or re-establishment of native vegetation. The limits of clearing within the construction site and protected habitat features will be clearly delineated using appropriate signage, barriers, fencing or markings;</p> <p>(c) requirements set out in the Landscape Design Guideline (RMS 2018);</p> <p>(d) procedures addressing relevant matters specified in the Biodiversity Guidelines - Protecting and managing biodiversity on RTA projects (RTA 2011) including but not limited to:</p> <ul style="list-style-type: none"> <li>• pre-clearing, including the outcomes of final flora and fauna species checks, establishment of exclusion zones and on-ground identification of specific habitat features to be retained (such as hollow-bearing trees)</li> <li>• vegetation clearing and bushrock removal, including staged habitat removal and any specified seasonal limits on clearing activities</li> <li>• fauna handling and unexpected threatened species finds</li> <li>• rehabilitation, revegetation, re-use of soils, woody debris and bushrock, and other habitat management actions</li> <li>• weed, pathogen and pest management</li> </ul> <p>(e) procedures addressing relevant matters specified in the NSW DPI (Fisheries) Policy and guidelines for fish habitat conservation and management.</p> <p>(f) monitoring during construction and post-construction</p>	Construction contractor	Pre-construction and construction



Impact	Environmental safeguards	Responsibility	Timing
	(g) adaptive management measures to be applied if monitoring indicates unexpected adverse impacts.		
Biodiversity	<p>Measures to further avoid and minimise the construction footprint and native vegetation or habitat removal will be considered during the detailed design stage and implemented where practicable and feasible. Measures to avoid and minimise impacts should be prioritised in the following order:</p> <ul style="list-style-type: none"> <li>(a) critical habitat</li> <li>(b) threatened species, endangered ecological communities, groundwater dependent ecosystems or their habitat</li> <li>(c) native vegetation and habitat supporting flora and fauna connectivity and/or that supports other environmental objectives such as protecting water quality, hydrology or erosion and sediment controls</li> <li>(d) native vegetation of higher quality condition</li> <li>(e) other native vegetation</li> </ul>	Construction contractor	Pre-construction and construction
Biodiversity	<p>Consistent with the Biodiversity Guidelines - Protecting and managing biodiversity on RTA projects (RTA 2011), and any specific requirements of the approved Flora and Fauna Management Plan, management arrangements will be implemented to ensure unavoidable vegetation and bushrock removal minimises biodiversity impacts as far as practicable. As a minimum that will include:</p> <ul style="list-style-type: none"> <li>(a) no vegetation clearing or bushrock removal beyond limits identified in this</li> <li>(b) avoiding identified exclusion zones and protected habitat features.</li> <li>(c) avoiding mixing of topsoil with woody debris materials</li> <li>(d) separation of woody vegetation suitable for re-use during construction and rehabilitation or revegetation works</li> <li>(e) implementation of staged clearing</li> <li>(f) trimming and pruning to be undertaken in accordance with relevant Australian Standards</li> <li>(g) in riparian zones: avoiding clearing during likely flood periods; ensuring cleared vegetation does not enter the waterway; installation of suitable sedimentation and erosion control; retaining roots and stumps to maintain bank stability; applying the hierarchy for snag management set out in the Guidelines.</li> </ul>	Construction contractor	Pre-construction and construction

Impact	Environmental safeguards	Responsibility	Timing
Biodiversity	<p>Prior to the commencement of construction, carry out:</p> <ul style="list-style-type: none"> <li>• Targeted surveys to confirm the presence of the following along the Hunter River and unnamed tributary to the north of the Hunter River within the area to be impacted by the proposal <ul style="list-style-type: none"> <li>○ River red gum (<i>Eucalyptus camaldulensis</i>) (endangered population - BC Act)</li> <li>○ Hunter Floodplain Red Gum Woodland in the NSW North Coast and Sydney Basin Bioregions (EEC – BC Act)</li> </ul> </li> <li>• Threatened flora survey, fauna habitat assessments and ground-truthing of vegetation mapping, between the Hunter River and the southern extent of the area surveyed by Umwelt (2019), north of the New England Highway near Gowrie Gates, within the area to be impacted by the proposal</li> <li>• Ground truthing surveys of the regional vegetation mapping within the McDougalls Hill ancillary facility to confirm presence of: <ul style="list-style-type: none"> <li>○ Central Hunter Ironbark – Spotted Gum – Grey Box Forest in the NSW North Coast and Sydney Basin Bioregions EEC (BC Act)</li> <li>○ Central Hunter Valley Eucalypt Forest and Woodland CEEC (EPBC Act)</li> </ul> </li> </ul> <p>No clearing of threatened native vegetation is to be carried out within the McDougalls Hill ancillary facility.</p> <p>Subject to the outcomes of the above, a consistency review or environmental assessment may be required.</p>	Construction contractor	Pre-construction
Biodiversity	<p>The unexpected species find procedure is to be followed under <i>Biodiversity Guidelines: Protecting and managing biodiversity on RTA projects</i> (RTA 2011) if threatened ecological communities, not assessed in the biodiversity assessment, are identified in the proposal site.</p>	Construction contractor	Construction
Biodiversity	<p>A nest box strategy would be developed and implemented during the detailed design stage in accordance with <i>Guide 5: Re-use of woody debris and bushrock</i> and <i>Guide 8: Nest boxes of the Biodiversity Guidelines: Protecting and managing biodiversity on RTA projects</i> (RTA 2011). The strategy is to include:</p> <ol style="list-style-type: none"> <li>(a) a trial of artificial hollow creations.</li> <li>(b) reinstallation of suitable hollows removed by</li> </ol>	Construction contractor	Detailed design

Impact	Environmental safeguards	Responsibility	Timing
	<p>the proposal.</p> <p>(c) installation of nest boxes in the event that there are not sufficient trees for artificial hollow creation and hollows for reinstallation.</p>		
Biodiversity	<p>Prior to the commencement of construction, carry out monitoring to determine the presence of threatened microbats in the culverts that are part of the former Great Northern Railway.</p> <p>If threatened microbats are identified, collect the following information:</p> <p>(a) Species present.</p> <p>(b) Total number of individuals and groups per occupied roost site.</p> <p>(c) Description of occupied roost sites.</p> <p>(d) Breeding status of the colony, including approximate adult to juvenile ratios.</p>	Construction contractor	Pre-construction
Biodiversity	<p>If roosting threatened microbats are found during pre-construction monitoring, a Bat Management Plan is to be developed and implemented. The Bat Management Plan is to be prepared by a microbat specialist and include the following:</p> <p>(a) A monitoring program for both during and outside of breeding periods.</p> <p>(b) Details of construction activities to be monitored that may affect microbat habitat, particularly light, noise, vibration, alteration of drainage into culverts.</p> <p>(c) Mitigation measures to be implemented during construction, including regular inspections of impacts from sedimentation and weed encroachment to culvert entrances, consider timing and nature of immediately adjacent works in relation to known breeding period of relevant threatened microbats.</p> <p>(d) Adaptive management measures to be implemented if monitoring indicates a decline in bat numbers or if bats are observed leaving the roost during construction activities.</p> <p>(e) A process for evaluating the effectiveness of management measures.</p>	Construction contractor	Pre-construction/ construction/ post construction
Biodiversity	<p>In accordance with Section 199 of the FM Act, Roads and Maritime would notify DPI Fisheries in writing of any proposed dredging or reclamation in the Hunter River and its tributary. Roads and Maritime would consider any matters raised by the Minister.</p>	Roads and Maritime	Pre-construction



Impact	Environmental safeguards	Responsibility	Timing
Biodiversity	In accordance with Section 219 of the FM Act, Roads and Maritime would seek a permit from DPI Fisheries for any temporary blockage of fish passage. Roads and Maritime would consider any matters raised by the Minister.	Roads and Maritime	Pre-construction
Biodiversity	Instream silt curtains would be implemented and maintained for construction in the Hunter River. Silt curtains would be installed such that they do not block fish passage.	Construction contractor	Construction
Biodiversity	Changes to existing surface water flows would be minimised through detailed design. Any rock platform required to be constructed within the Hunter River bridge would be designed and constructed to prevent blocking the main river channel. The platform would be designed to ensure that flow of the main river channel and fish passage is maintained even during low flow periods. The Department of Primary Industry (DPI) would be consulted on the final design.	Construction contractor	Detailed design
Biodiversity	A wildlife connectivity strategy would be finalised and implemented during the detailed design stage in accordance with the draft Roads and Maritime Wildlife Connectivity Guidelines (RMS 2011). The strategy is to focus on maintaining connectivity in the northern extent of the proposal and is to include, but not be limited to: (a) provision for a rope crossing with an indicative location between chainages 8450 and 8725 (b) identification of trees suitable for retention in the northern connection and tie in to facilitate glider crossings (c) consideration of additional gliding crossing structures where the width of disturbance is greater than 50 metres (d) type and extent of any associated landscaping or structures such as fencing or fauna infrastructure	Construction contractor	Detailed design

### 6.1.5 Biodiversity offsets

The Roads and Maritime Guideline for Biodiversity Offsets requires consideration of biodiversity offsets when threatened ecological communities or threatened species habitat is impacted above specified thresholds, as detailed in Table 6-7 below.

Table 6-7 Offsetting Thresholds for REFs (Roads and maritime 2016)

Description of Activity or Impact	Consider Offsets or Supplementary Measures
Works involving clearing of national or NSW listed critically endangered ecological communities (CEEC)	Where there is any clearing of an CEEC in moderate to good condition
Works involving clearing of nationally listed threatened ecological community (TEC) or nationally listed threatened species habitat	Where clearing greater than one hectare of a TEC or habitat in moderate to good condition
Works involving clearing of NSW endangered or vulnerable ecological community	Where clearing greater than five hectares or where the ecological community is subject to an SIS
Works involving clearing of NSW listed threatened species habitat where the species is a species credit species as defined in the OEH Threatened Species Profile Database (TSPD)	Where clearing greater than one hectare or where the species is the subject of an SIS
Works involving clearing of NSW listed threatened species habitat and the species is an ecosystem credit species as defined in OEH's Threatened Species Profile Database (TSPD)	Where clearing greater than five hectares or where the species is the subject of an SIS
Type 1 or Type 2 key fish habitats (as defined by NSW Fisheries)	Where there is any net loss of habitat

The proposal triggers the offsetting thresholds for the following matters:

- Clearing of 16.89 hectares of EPBC Act listed Central Hunter Valley Eucalypt Forest and Woodland CEEC
- Clearing of 13.98 hectares of BC Act listed Central Hunter Ironbark – Spotted Gum – Grey Box Forest in the NSW North Coast and Sydney Basin Bioregions EEC
- Clearing of greater than one hectare of BC Act listed threatened species credit species habitat.
  - Southern myotis 11.2 hectares (includes all woodland and forest habitat within 200 metres of dams, sandstone culverts and hunter river)
  - Squirrel glider 13.2 hectares (includes all woodland and forest habitat, excluding the riparian vegetation along the Hunter River)
  - Brush-tailed phascogale 13.2 hectares (includes all woodland and forest habitat, excluding the riparian vegetation along the Hunter River).

A preliminary Biodiversity Assessment Methodology credit calculator assessment determined the following credit requirements, as detailed in Table 6-8.

Table 6-8 Preliminary Biodiversity Credit Requirements according to the BAM (Roads and Maritime 2016)

Threatened Ecological Community/Threatened Species	Biodiversity Credits Required
Central Hunter Valley Eucalypt Forest and Woodland CEEC (EPBC Act)*	Overall Ecosystem credits = 466 CEEC component = 452
Central Hunter Ironbark – Spotted Gum – Grey Box Forest in the NSW North Coast and Sydney Basin Bioregions EEC (BC Act)*	Overall Ecosystem credits = 466 EEC component = 419

Threatened Ecological Community/Threatened Species	Biodiversity Credits Required
Southern myotis	377
Squirrel glider	419
Brush-tailed phascogale	419

\*note that the ecosystem credits requirements for the Central Hunter Valley Eucalypt Forest and Woodland CEEC (EPBC Act) and Central Hunter Ironbark – Spotted Gum – Grey Box Forest in the NSW North Coast and Sydney Basin Bioregions EEC (BC Act) largely overlap.

Under an agreement with DoEE, Roads and Maritime must carry out a Strategic Assessment of the impacts on ‘Specified Protected Matters’. The proposal is likely to have a significant impact on the Central Hunter Valley Eucalypt Forest and Woodland CEEC which is identified as a ‘Specified Protected Matter’.

In keeping with the strategic assessment agreement, Roads and Maritime would, as part of detailed design, reduce impacts where possible to this Specified Protected Matter and consult with DoEE regarding the activity.

Residual impacts to the CEEC would be offset through the retirement of biodiversity credits.

Fulfilling offset requirements under the BC Act may be achieved by Roads and Maritime using one or more of the following offset strategies:

- In-perpetuity conservation through the establishment of a Stewardship site and the retirement of credits
- Securing required credits through the open credit market
- Payments to the Biodiversity Conservation Fund.