Biodiversity Assessment Report

Appendix J

Appendix J — Biodiversity Assessment Report

J

Berrima Rail Project

Biodiversity Assessment Report

Prepared for Hume Coal Pty Limited | 2 March 2017

Berrima Rail Project

Biodiversity Assessment Report

Prepared for Hume Coal Pty Limited | 2 March 2017

Ground Floor, Suite 01, 20 Chandos Street
St Leonards, NSW, 2065

T +61 2 9493 9500
F +61 2 9493 9599
E info@emmconsulting.com.au

www.emmconsulting.com.au

Berrima Rail Project

Final

Report J12055RP1 | Prepared for Hume Coal Pty Limited | 2 March 2017

Prepared by	**Katie Whiting**	Approved by	**Nicole Armit**
Position	Ecology Services Manager	Position	Environmental Assessment and Management Services Manager
Signature		Signature	
Date	2 March 2017	Date	2 March 2017

Document Control

Version	Date	Prepared by	Reviewed by
1	20 January 2017	Katie Whiting	Nicole Armit
2	2 March 2017	Katie Whiting	Nicole Armit

T +61 (0)2 9493 9500 | F +61 (0)2 9493 9599

Ground Floor | Suite 01 | 20 Chandos Street | St Leonards | New South Wales | 2065 | Australia

www.emmconsulting.com.au

Table of contents

Table of contents *(Cont'd)*

Appendices

Tables

Figures

Photographs

1 Introduction

1.1 Overview

Hume Coal Pty Limited (Hume Coal) is seeking approval for the construction and operation of a new rail spur and loop in the Southern Highlands region of New South Wales (NSW) (the Berrima Rail Project). Hume Coal is also seeking approval in a separate State significant development application to develop and operate the Hume Coal Project; an underground coal mine and associated mine infrastructure in the NSW Southern Coalfields. Coal produced by the Hume Coal Project will be transported to port for export or to domestic markets by rail via a new rail spur and loop, constructed as part of the Berrima Rail Project.

Approval for the Berrima Rail Project (the project) is being sought under Part 4, Division 4.1 of the NSW *Environmental Planning and Assessment Act 1979* (EP&A Act). An environmental impact statement (EIS) is a requirement of the approval processes. This Biodiversity Assessment Report (BAR) forms part of the EIS. It documents the methodology and results of the assessment, the measures taken to avoid and minimise impacts and the additional mitigation and management measures proposed.

The location of the project is shown in Figure 1.1, and the local context around the project area is illustrated in Figure 1.2.

1.2 Project description

The Berrima Rail Project will enable the transportation of coal produced by the Hume Coal Project to various customers. The new rail spur and loop will be connected to the western end of the existing Berrima Branch Line; a privately owned line branching off the Main Southern Rail Line at the Berrima Junction approximately 2.5 km north of Moss Vale. The Berrima Branch Line is owned and used by Boral Cement Ltd (Boral) for the transportation of cement, limestone, coal and clinker to and from the Berrima Cement Works. It is also used by Inghams Enterprises Pty Limited (Inghams) for the transportation of grain to its feed mill east of the cement works, and by Omya (Australia) Pty Ltd (Omya) for the transportation of limestone to their Moss Vale plant at the Berrima Junction.

In addition to the construction of the new rail spur and loop, the project also involves upgrades to the Berrima Branch Line and the use of the rail infrastructure by Hume Coal and Boral. The rail project and the Hume Coal Project are the subject of two separate development applications as the rail project involves rail infrastructure used by users other than Hume Coal, as noted above.

Hume Coal will transport product coal by rail, primarily to Port Kembla for export, and possibly to the domestic market depending on demand. Hume Coal will transport up to 3.5 Million tonnes per annum (Mtpa) of product coal which will require up to eight train paths per day (four in each direction), with a typical day involving four to six paths (two to three in each direction).

In summary the project involves:

- upgrades to Berrima Junction (at the eastern end of the Berrima Branch Line) to improve the operational functionality of the junction, including extending the number 1 siding, installation of new turnouts and associated signalling;
- construction of a new rail line connected to the western end of the existing Berrima Branch Line approximately 700 m east of the Berrima Cement Works;
- construction of a railway bridge over Berrima Road;
- construction of a new rail connection into the Berrima Cement Works from the railway bridge;

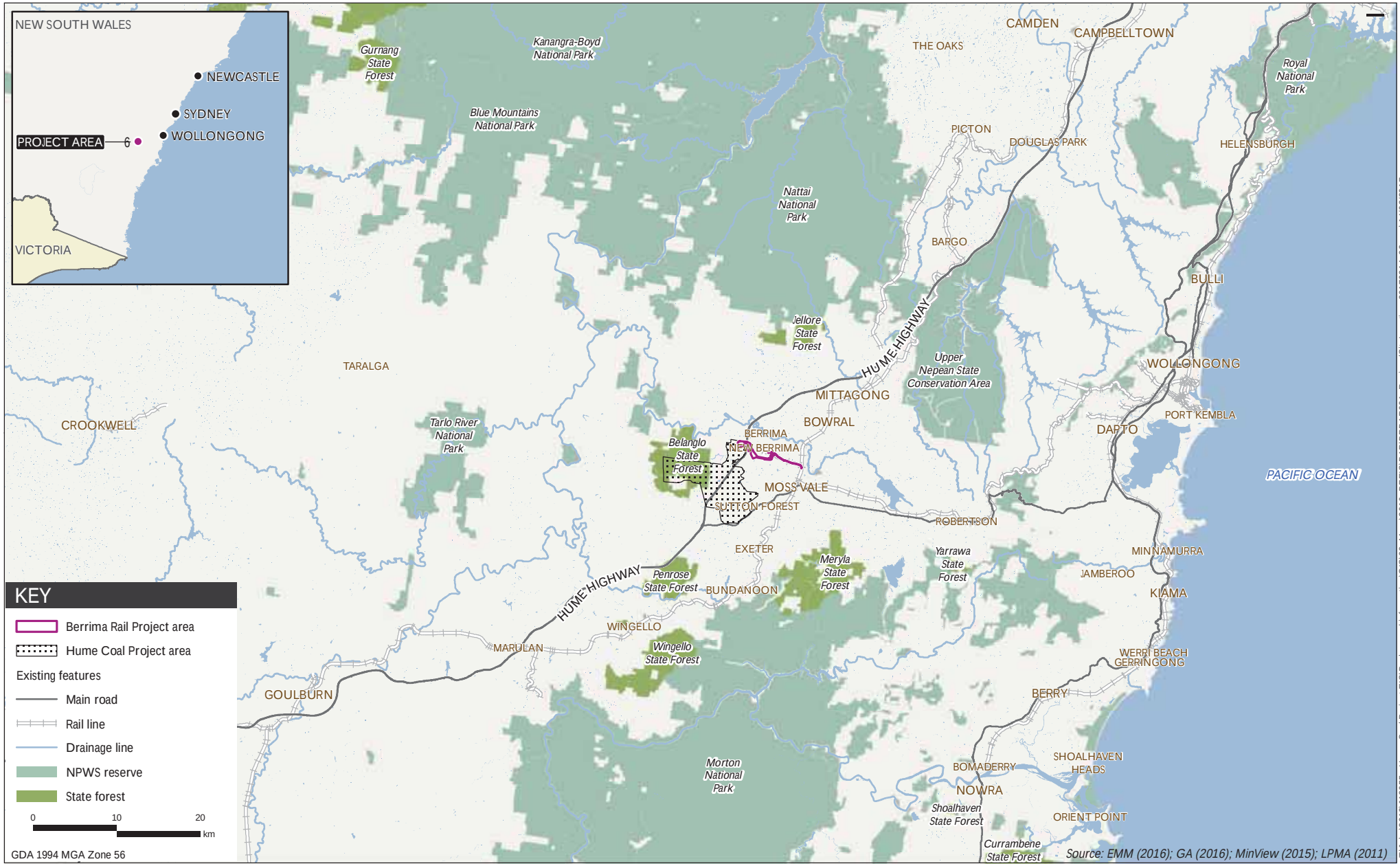
- decommissioning of the existing rail connection into the Berrima Cement Works including the Berrima Road level rail crossing;
- construction of a new rail spur line from the Berrima Branch Line connection to the Hume Coal Project coal loading facility;
- construction of a grade separated crossing (railway bridge) over the Old Hume Highway;
- construction and operation of a maintenance siding and basic provisioning facility on the western side of the Old Hume Highway, including an associated access road, car parking and buildings; and
- construction of the Hume Coal rail loop with the Hume Coal Project Area, adjacent to Medway Road.

The conceptual project layout is illustrated in Figure 1.3. As shown, approval is sought for two alignments of the new rail line where it will cross Berrima Road. The preferred option is the blue rail alignment shown in Figure 1.3, which includes construction of a railway bridge over Berrima Road as described in the points above. This preferred project design has been developed in consultation with Boral as the owner of the Berrima Branch Line.

The alternative option (orange alignment in Figure 1.3) accounts for a proposal by Wingecarribee Shire Council (WSC) to realign approximately 700 m of Berrima Road between Taylor Avenue and Stony Creek to replace the T-intersection at Berrima Road and Taylor Avenue with a roundabout, and to replace the existing rail level crossing into the Berrima Cement Works with a rail overbridge. If WSC relocates Berrima Road to the alignment shown in Figure 1.3, then the following project components would vary:

- the turnout for the new spur line to service the Hume Coal Project would be installed on the existing Berrima Branch Line approximately 1000 m east of the cement works. A short section of the existing Berrima Branch Line would be shifted north, within the rail corridor on Boral-owned land, to accommodate the spur line;
- the construction of a railway bridge over Berrima Road would be replaced by a railway underpass beneath the realigned Berrima Road, constructed through the elevated embankment for the road;
- the construction of a new rail connection into the Berrima Cement Works from the railway bridge would no longer be required, and the cement works access would remain unchanged; and
- the existing rail connection into the Berrima Cement Works and the Berrima Road level rail crossing would not be decommissioned, since the road would be realigned to pass over the existing rail alignment using a bridge.

This BAR has considered the impacts of both options shown in Figure 1.3.

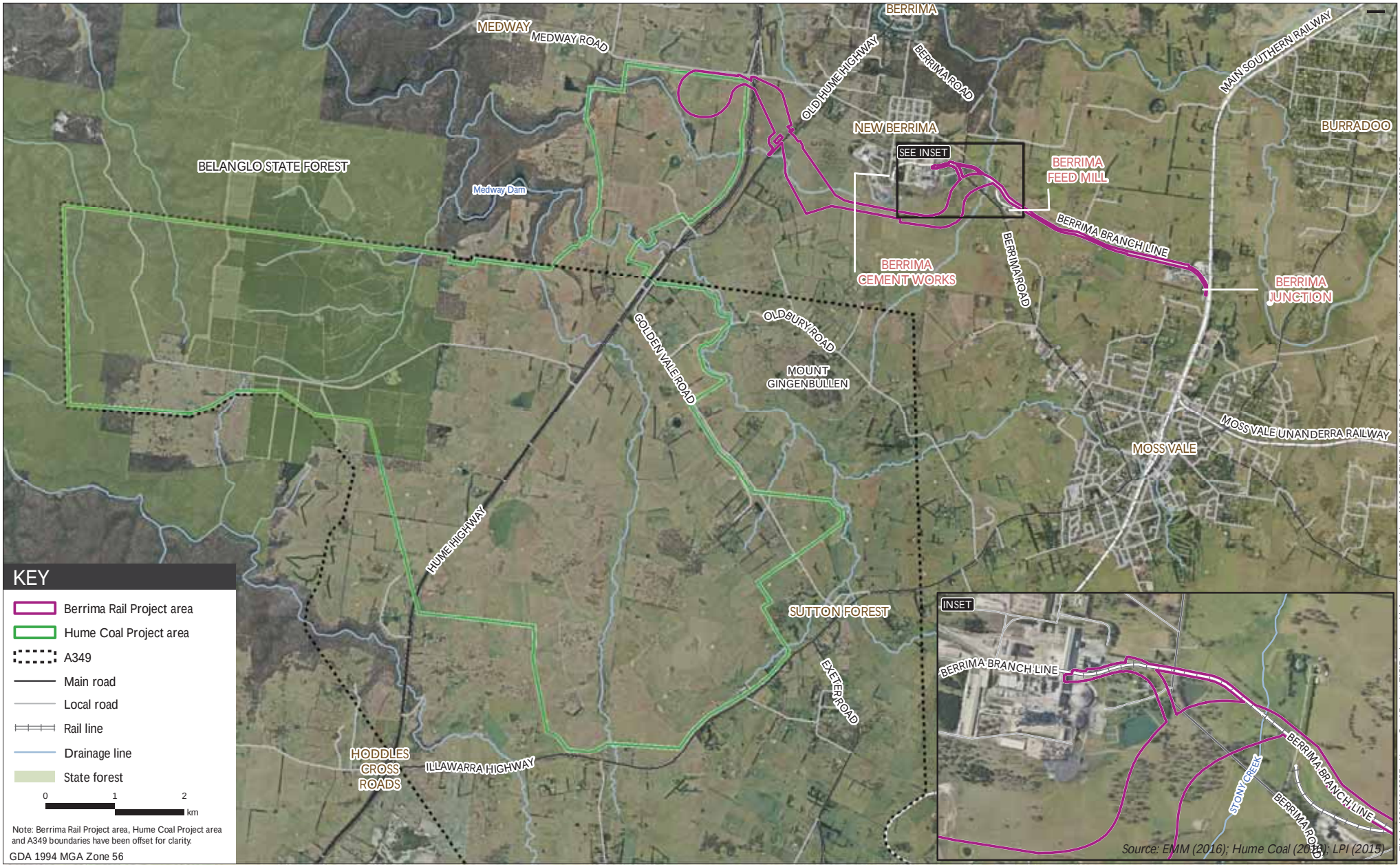


Locality plan

Berrima Rail Project

Biodiversity assessment report

Figure 1.1

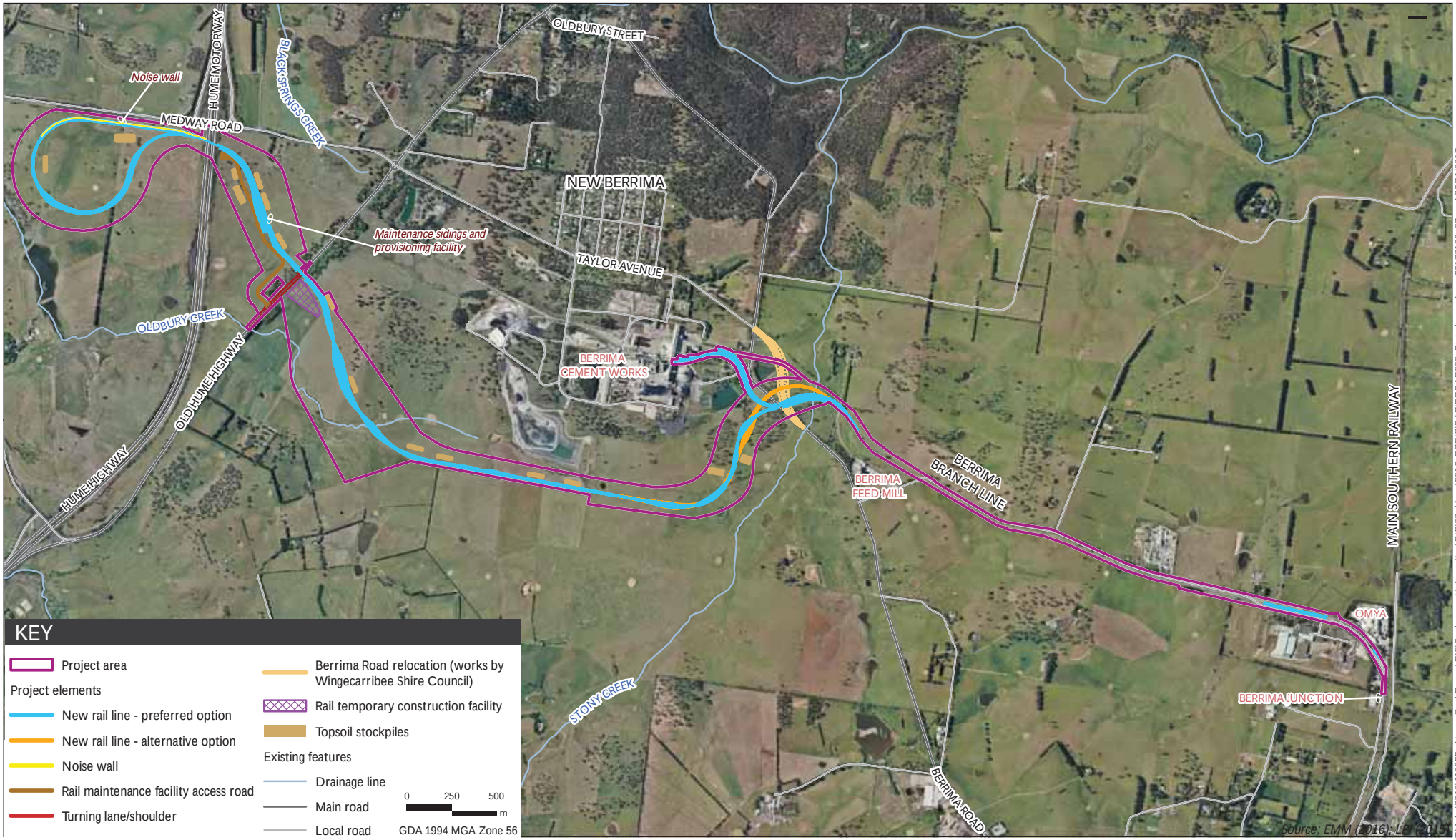


Local context

Berrima Rail Project

Biodiversity assessment report

Figure 1.2



Conceptual project components

Berrima Rail Project

Biodiversity assessment report

Figure 1.3

1.3 Project area

The project area is located in the Southern Highlands region of NSW in the Wingecarribee local government area, approximately 100 km south-west of Sydney. It occupies a corridor that is around 8 km long, stretching from the Berrima Junction on the outskirts of Moss Vale, heading west in parallel with Douglas Road past the Berrima Feed Mill, around the southern side of the Berrima Cement Works, across the Old Hume Highway and under the Hume Highway through an existing underpass into the Hume Coal Project area, south of Medway Road.

The project area is in a semi-rural setting. It is surrounded by grazing properties, small-scale farm businesses, scattered rural residences, large and small industries and is traversed by the Hume Highway. The project area contains predominately cleared agricultural land consisting of improved pasture for grazing, and over a third of the area comprises the existing Berrima Branch Line.

The villages of New Berrima, Berrima and Moss Vale are located in the general area. Medway is also located nearby while Bowral and Mittagong are located between 6 and 10 km north-east of the eastern end of the project area, respectively. There are also scattered homesteads, dwellings and other built structures associated with agricultural production surrounding the project area.

1.4 The study area

The study area for the biodiversity assessment is shown in Figure 2.1. The edge of a large patch of vegetation occurs in the study area. Accordingly, the study area was extended outside the project area in this location so that the patch of vegetation could be accurately characterised.

1.5 Assessment guidelines and requirements

This BAR was prepared in accordance with the *Framework for Biodiversity Assessment: NSW Biodiversity Offsets Policy for Major Projects* (OEH 2014). It identifies potential direct and indirect impacts of the project on threatened biodiversity listed under the NSW *Threatened Species Conservation Act 1995* (TSC Act) and Commonwealth *Environment Protection and Biodiversity Act 1999* (EPBC Act). It also addresses potential impacts of the project on riparian land, aquatic environments and groundwater dependent ecosystems.

The BAR demonstrates how measures have been incorporated into the project design to avoid and minimise impacts on biodiversity and measures to mitigate impacts during construction and operation. A biodiversity offset strategy is provided to compensate for residual biodiversity impacts after avoidance; minimisation and mitigation measures have been applied. The study assesses the impacts of the preferred and alternative project options (refer to Figure 1.3).

This assessment has been prepared in accordance with requirements of the DP&E, as set out in the SEARs for the project. A copy of the SEARs is attached to the EIS as Appendix B. Table 1.1 lists individual requirements relevant to this biodiversity assessment and where they are addressed in this report.

Table 1.1 Biodiversity – relevant SEARs issued by DP&E

SEAR	Where addressed
An assessment of the likely biodiversity impacts of the development, in accordance with the Framework for Biodiversity Assessment, by a person accredited in accordance with s142(B)(1)(c) of the *Threatened Species Conservation Act 1995*, and having regard to OEH's and DPI's requirements and recommendations.	This assessment has been prepared in accordance with the SEARS by Katie Whiting of EMM, accredited assessor number 196. The compliance of the assessment against the FBA mapping requirements is provided in Appendix D.
A strategy to offset any residual impacts of the development in accordance with the NSW Biodiversity Offsets Policy for Major projects.	An offset strategy is presented in Chapter 7.

DP&E invited other government agencies to recommend matters to address in the EIS. NSW Fisheries, OEH, and DPI Water raised requirements relevant to biodiversity, as reproduced in Table 1.2.

Table 1.2 NSW Fisheries and OEH assessment recommendations relating to biodiversity

Agency	Requirement	Where addressed
NSW Fisheries	Analysis of any interactions of the proposed rail project with aquatic and riparian environments and predictions of any impacts upon aquatic and riparian environments (including fish and aquatic and riparian vegetation) from the rail project (both temporary and permanent). This should include assessment of both direct impacts (removal, disturbance, smothering) and indirect impacts (e.g. shading, permanent loss of habitat).	Indirect impacts on riparian vegetation are addressed in Section 4.3.6, while potential impacts on the riparian and aquatic environment are addressed in Section 4.3.1.
OEH	Assessment of the potential impact on biodiversity, including threatened species, populations, ecological communities, or their habitats likely to occur within or near the subject site.	An assessment of potential direct and indirect impacts of the project on threatened biodiversity is provided in Chapter 4.
OEH	Biodiversity impacts related to the proposed development are to be assessed and documented in accordance with the Framework for Biodiversity Assessment (FBA), unless otherwise agreed by OEH, by a person accredited in accordance with s142B(1)(c) of the *Threatened Species Conservation Act 1995*.	This biodiversity chapter has been prepared to meet the reporting requirements of the FBA by Katie Whiting, accredited assessor 196.
OEH	Impacts on the following populations will require further consideration and provision of the information specified in s9.2 of the Framework for Biodiversity Assessment: • Black Gum (*Eucalyptus aggregata*)	The potential impacts of the project on Black Gum are assessed in Section 4.2.
DPI Water	Assessment of impacts on surface and groundwater sources (both quality and quantity) related infrastructure, adjacent licensed water users, basic landholder rights, watercourses, riparian land and groundwater dependent ecosystems, and measures proposed to reduce and mitigate these impacts.	An assessment of riparian land and groundwater dependent ecosystems is provided in Section 4.3.6, while mitigation measures are provided in Section 5.2. An assessment of surface and groundwater impacts and mitigation measures is provided in Chapter 13 of the EIS.

2 Methods

2.1 Database searches

Table 2.1 summarises the database searches performed to identify any threatened terrestrial flora and fauna species, important habitat for migratory species and/or critical habitats recorded in and surrounding the study area. Threatened species, populations and communities listed under the TSC Act and/or EPBC Act previously recorded or predicted to occur within an approximate 10 km of the study area are provided in Table 2.3 and Table 2.4.

Preliminary listing advices were also consulted under the TSC and EPBC Acts to determine any species, populations or communities that may be listed in the future, or existing species that may increase in conservation status (ie existing vulnerable species that are proposed to be upgraded to endangered).

Table 2.1 Biodiversity database search details

Source	Search date(s)	Search extent
PlantNET spatial database search for rare and threatened Australian Plants http://plantnet.rbgsyd.nsw.gov.au/search/spatial.htm	22 March 2016	Wingecarribee LGA
Atlas of NSW Wildlife www.environment.nsw.gov.au/atlasapp/	2 November 2015 22 March 2016	10 km radius around approximate study area
Protected Matters Search Tool www.environment.gov.au/webgis-framework-apps/pmst/pmst.jsf/	2 November 2015 22 March 2016 Review of new listings on 5 May 2016	10 km radius around approximate study area
NSW Vegetation Information System (VIS) Classification Database, Vegetation Benchmarks Database and Over-cleared Landscapes Database www.environment.nsw.gov.au/	2 November 2015 22 March 2016	Hawkesbury-Nepean Major Catchment Area (MCA)
Threatened species profile database www.environment.nsw.gov.au/atlasapp/	2 November 2015 22 March 2016	Relevant species within Hawkesbury-Nepean MCA
Critical habitat register www.environment.nsw.gov.au/criticalhabitat/CriticalHabitatProtectionByDoctype.htm	2 November 2015 22 March 2016	All registered sites were searched. No areas of declared critical habitat within or adjacent to the study area.
Australian Wetlands Database http://www.environment.gov.au/topics/water/water-our-environment/wetlands/australian-wetlands-database	2 November 2015 22 March 2016	Search by name for each wetland within approximately 10 km of the study area
Department of Primary Industries Records Viewer www.dpi.nsw.gov.au/fishing/species-protection/records	14 July 2016	Search for threatened species and communities in the Wingecarribee LGA
Key Fish Habitat Map: Wingecarribee www.dpi.nsw.gov.au/_data/assets/pdf_file/0011/634376/Wingecarribee.pdf	14 July 2016	Determining the key fish habitats in the study area

Table 2.1 Biodiversity database search details

Source	Search date(s)	Search extent
Preliminary determinations by date (TSC Act) http://www.environment.nsw.gov.au/committee/PreliminaryDeterminationsByDate.htm	14 July 2016	Search of all preliminary determinations
Listing assessments for public comment (EPBC Act) http://www.environment.gov.au/biodiversity/threatened/nominations/comment	14 July 2016	Search of all preliminary determinations

2.2 Vegetation survey methods

2.2.1 Vegetation mapping review

Existing vegetation mapping and databases were reviewed to provide information on the vegetation communities previously recorded or likely to occur in the study area. Table 2.2 provides a summary of information reviewed and data obtained for the study area.

Table 2.2 Vegetation information reviewed and data obtained

Source	Data obtained	Relevance to the assessment
Wingecarribee Biodiversity Strategy (EcoLogical 2003)	Vegetation types for the Wingecarribee LGA	Indicative of vegetation types in the wider study area
Biometric Vegetation Types (DECC 2012)	Vegetation types for the Hawkesbury-Nepean MCA	Used to assign vegetation of the study area to a biometric type
Vegetation Information System (VIS) database (OEH 2016a)	Plant community types for the Hawkesbury Nepean MCA	Used to determine the plant community types present in the region

2.2.2 Vegetation type mapping

Vegetation type boundaries were mapped in the field, either on foot or from a vehicle, using a global positioning satellite (GPS) receiver, whilst referencing aerial photographs and topographic maps. Field-based assessments were followed by aerial photograph interpretation and analysis using a geographic information system (GIS) to create a comprehensive vegetation map of the entire study area.

Once vegetation types within the study area had been identified, the NSW Biometric Vegetation Types Database (DECC 2012) was reviewed to provide an appreciation of the extent and distribution of these vegetation types within the locality and region more broadly.

2.2.3 Plot based surveys

Seven plots and transects were completed in accordance with Section 5.3.2 of *Framework for Biodiversity Assessment: NSW Biodiversity Offsets Policy for Major Projects* (OEH 2014), hereafter referred to as the FBA. Surveys were completed over four days (11 September 2015 and 28 to 30 September 2015). As required by the policy, plots were in a 20 x 20 m area and transects were 50 m long. Plot and transect data was compared to the OEH Plant Community Type (PCT) Database (OEH 2016a) and to the final determinations of threatened communities predicted to occur in the area. Plot assessment locations are shown in Figure 2.1.

Seven (20 x 20 m) plot and transect (50 m) flora surveys were undertaken in the study area in accordance with Section 5.3.2 of the FBA. The FBA provides guidance on how many plots and transects are needed for each 'vegetation zone' to ensure adequate survey coverage across a study area. Accordingly, the number of quadrats to be completed was determined through stratification using regional vegetation mapping for the area, and then calculating the requisite number of plots and transects for each 'strata' or 'vegetation zone' in the study area.

In accordance with Section 5.3.2 of the FBA, site attributes recorded in the plots and transects included:

- native plant species richness;
- native plant cover (percentage cover) within the canopy, mid-storey and groundcover, respectively;
- exotic plant cover (percentage cover) within each vegetation stratum/percentage of the total mid-storey and ground cover;
- the number of trees with hollows;
- proportion of canopy species occurring as regeneration; and
- the total length of fallen logs.

The locations of plots and transects are shown on Figure 2.1.

2.2.4 Threatened ecological community identification

Vegetation plot data and rapid assessment data were reviewed against the Commonwealth and NSW Government descriptions of threatened ecological communities (TECs) known from the region, to determine their presence (or otherwise) in the study area. A comparison was also undertaken with published TEC species lists, habitat descriptions and distributions, and published identification guidelines.

2.3 Targeted species surveys

2.3.1 Candidate flora species

The results of the desktop study identified threatened flora species (listed under the EPBC Act and/or TSC Act) previously recorded, or predicted to occur (based on known distributions and the potential presence of suitable habitat), in or near the study area. The results were also used to identify threatened flora species (listed under the EPBC Act and/or TSC Act) to target during the surveys. These were generally those species previously recorded, or predicted to have a moderate or high likelihood of occurring (based on known distributions and the potential presence of suitable habitat), in or near the study area.

Table 2.3 lists the species targeted and the survey detection methods and timing. Flora searches were timed to maximise the potential for identification of the threatened species being targeted. As surveys were completed in September 2015, targeted surveys were completed for all candidate flora species within their optimal survey timing.

Table 2.3 Candidate flora species

Species	TSC Act status	EPBC Act status	Survey methods	Optimal survey timing
Dwarf Kerrawang *Rulingia prostrata*	E	E	Targeted flora search	Year round
Dwarf Phyllota *Phyllota humifusa*	V	V	Targeted flora search	Year round
Bynoe's Wattle *Acacia bynoeana*	E	V	Targeted flora search	September to March
Black Gum *Eucalyptus aggregata*	V (species) E (population)	V	Targeted flora search	February to December
Hoary Sunray *Leucochrysum albicans* var. *tricolor*	-	E	Targeted flora search	Year round
Paddys River Box *Eucalyptus macarthurii*	E	E	Targeted flora search	Year round
Cambage Kunzea *Kunzea cambagei*	V	V	Targeted flora search	Year round
Mittagong Geebung *Persoonia glaucescens*	E	V	Targeted flora search	Year round

Notes: 1.TSC Act - Threatened Species Conservation Act 1995, EPBC Act - Environment Protection and Biodiversity Conservation Act 1999.

2. V - vulnerable, E – endangered.

2.3.2 Targeted flora survey methods

Targeted searches for threatened flora were undertaken over 56 person hours within suitable or potentially suitable habitats of the study area, using the random meander method. Targeted searches were undertaken at all flora survey locations shown on Figure 2.1. Survey effort was based on the vegetation type and the likely presence of suitable habitats. Where a rare or threatened species was recorded, the following data was collected:

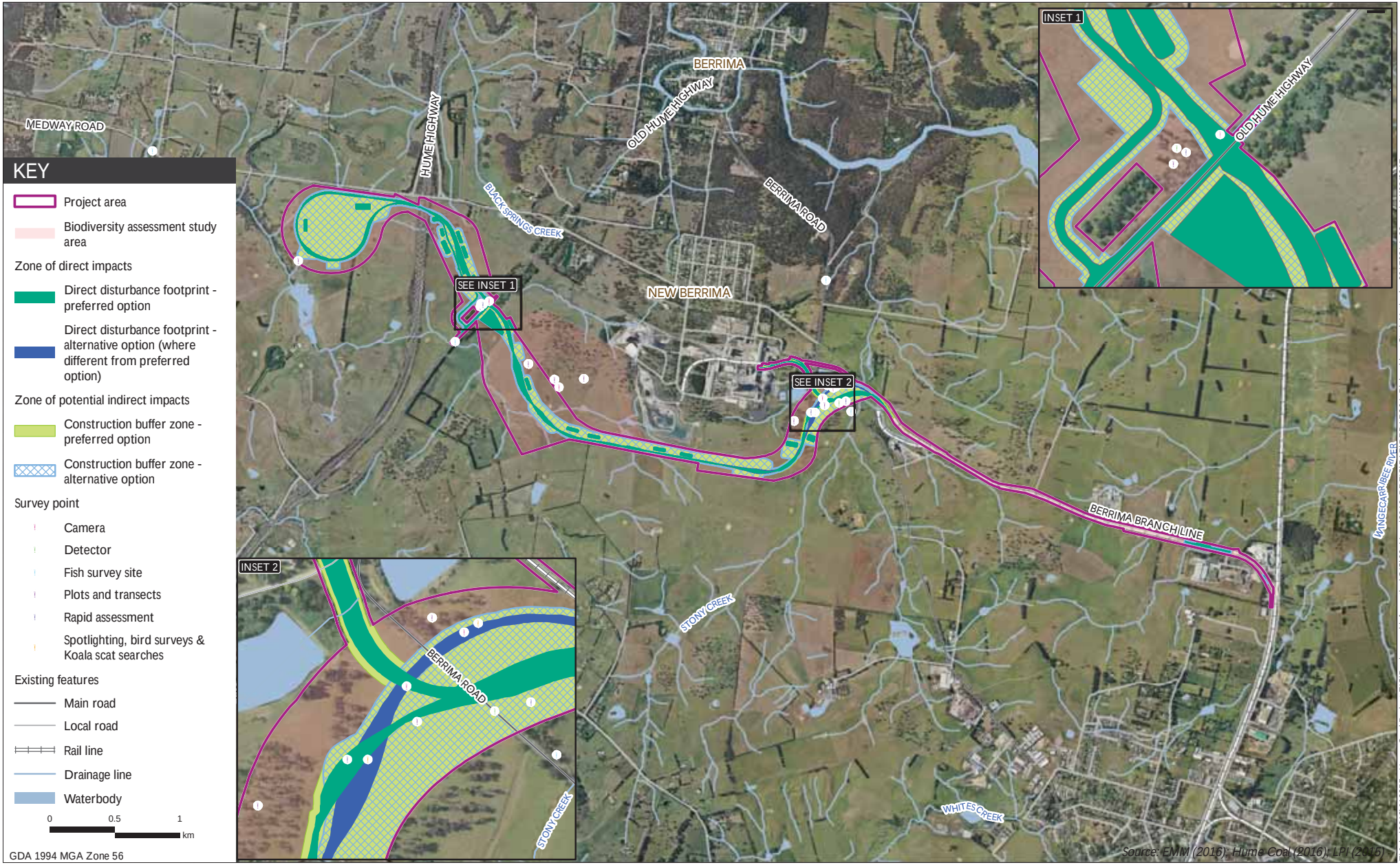
- number of individuals;
- reproductive status of the population (eg flowering/fruiting);
- the location(s) of each individual, recorded using a GPS (where individuals were less than 1 m apart, a single point was recorded and the number of plants at that point noted);
- habitat features present (eg rocky outcrops and associated flora species);
- aspect and/or degree of slope;
- vegetation type; and
- threats (if any) and/or previous disturbances.

The locations of targeted flora surveys are shown on Figure 2.1.

2.3.3 Fauna survey guidelines

Fauna surveys were also completed in accordance with the following guidelines:

- *Survey guidelines for Australia's threatened bats* (DEWHA 2010a);
- *Survey guidelines for Australia's threatened birds* (DEWHA 2010b);
- *Survey guidelines for Australia's threatened mammals* (SEWPaC 2011a); and
- *Threatened Biodiversity Survey and Assessment: Guidelines for Developments and Activities* (DEC 2004).



Biodiversity assessment study area and methods

Berrima Rail Project
Biodiversity assessment report
Figure 2.1

An assessment of the compliance of fauna surveys against these guidelines is provided in Table 2.4. All fauna surveys were compliant with the above guidelines, with the exception of three species. These species were therefore assumed to be present for impact assessment and offsetting purposes.

a. Target fauna species

All TSC Act threatened species recorded within 10 km of the study area were targeted during surveys. Records for the listed species predicted by the Protected Matters Search Tool (DoE 2016a) were interrogated on the Atlas of NSW Wildlife (OEH 2016b) and Atlas of Living Australia (ALA 2016) to determine if they had been recorded within 10 km of the study area. Species on this list greater than 10 km from the study area and not likely to occur (ie coastal species) were excluded from targeted surveys.

Survey methods for threatened fauna were determined following the results of the desktop study and assessment of the presence of suitable habitat. This was done following the same general process as for threatened flora, described above. Table 2.4 provides a list of threatened and migratory fauna species (listed under the EPBC Act and/or TSC Act) which were identified as having a moderate to high potential to occur prior to surveys. The table also summarises survey methods and optimal survey timing for detection. Surveys were completed for all threatened fauna during optimal survey timing.

Table 2.4 Candidate fauna species

Species	TSC Act status	EPBC Act status	Survey guidelines	Optimal survey timing[1]	Survey completed in accordance with guidelines[2] and optimal survey timing[1]?
Blue-billed Duck *Oxyura australis*	V	-	Searches in wetlands	Year round	Yes
Freckled Duck *Stictonetta naevosa*	V	-	Searches in wetlands	Year round	Yes
Australasian Bittern *Botaurus poiciloptilus*	E	E	Area search in each stratification unit	Year round	Yes
Little Eagle *Hieraeetus morphnoides*	V	-	Area search in each stratification unit	Year round	Yes
Australian Painted Snipe *Rostratula australis*	E	E	Area search in wetlands	Year round	Yes
Gang-gang Cockatoo *Callocephalon fimbriatum*	V	-	Area search in each stratification unit	Year round	Yes
Powerful Owl *Ninox strenua*	V	-	At least 6 visits per site (habitat area)	Year round	No. Only 3 visits were completed per site. The species presence has been assumed.
Masked Owl *Tyto novaehollandiae*	V	-	At least 6 visits per site (habitat area)	Year round	No. Only 3 visits were completed per site. The species presence has been assumed.

Table 2.4 Candidate fauna species

Species	TSC Act status	EPBC Act status	Survey guidelines	Optimal survey timing[1]	Survey completed in accordance with guidelines[2] and optimal survey timing[1]?
Varied Sittella *Daphoenositta chrysoptera*	V	-	Area search in each stratification unit	Year round	Yes
Scarlet Robin *Petroica boodang*	V	-	Area search in each stratification unit	Year round	Yes
Flame Robin *Petroica phoenicia*	V	-	Area search in each stratification unit	Year round	Yes
Spotted-tail Quoll *Dasyurus maculatus maculatus*	V	E	2 x 1 hour and 1 km up to 200 ha of stratification unit spotlighting and call playback Cameras left on site for a minimum of two weeks	Year round	Spotlighting and call playback were undertaken. Cameras were left on site for one week. The species presence has been assumed.
Koala *Phascolarctos cinereus*	V	V	Koala survey, habitat assessment and spot assessments	Year round	Yes
Squirrel Glider *Petaurus norfolcensis*	V	-	2 x 1 hour and 1 km up to 200 ha of stratification unit spotlighting and call playback 4 trap nights over two consecutive nights per 100 ha	Year round	Spotlighting and call playback were undertaken, however trapping was not. The species presence has been assumed.
Eastern Bentwing Bat *Miniopterus schreibersii oceanensis*	V	-	4 trap nights over two consecutive nights per 100 ha and/or two detectors for 2 nights per 100 ha	October to March	Yes
Southern Myotis *Myotis macropus*	V	-	Harp trapping and ultrasonic detection	October to March	Yes

Notes: *1. Optimal survey timing in accordance with the BioBanking Calculator.*

2. Survey guidelines listed in Section iii above.

3. TSC Act - Threatened Species Conservation Act 1995, EPBC Act - Environment Protection and Biodiversity Conservation Act 1999, V - vulnerable, E - endangered, Mi – migratory.

2.3.4 Fauna habitat assessment

An assessment of fauna habitat types and habitat condition was undertaken at each plot location (a 50 m buffer around each plot) to determine appropriate locations for targeted fauna surveys. Specific habitat features and signs that were searched for included:

- hollow-bearing trees, including stags;
- bush rock and rocky outcrops;
- logs and artificial cover (eg discarded metal roofing);
- wetlands, streams, rivers, dams and other water bodies;
- permanent soaks and seepages;
- areas that could act as dispersal corridors for plants and animals;
- winter-flowering eucalypts;
- nests, roosts, burrows and dens;
- glider feeding scars and Koala feed trees;
- chewed She-oak (*Allocasuarina spp*.) or Cypress Pine (*Callitris spp*.) cones; and
- scats.

2.3.5 Targeted diurnal bird surveys

Timed searches, each being 20 minutes in duration, were used to survey diurnal (day active) birds at four sites. Timed searches were extended to one person hour at sites where new species continued to be encountered.

The presence and abundance of all birds observed in the study area during the timed searches were recorded. Birds were identified visually, with the aid of binoculars and/or by call identification. Surveys commenced in the early morning, within an hour of sunrise, when bird activity is greatest (Bibbly, Burgess and Hill 1992). Survey locations are shown in Figure 2.1.

2.3.6 Targeted microbat surveys

Ultrasonic (Wildlife Acoustics SM2Bat) detectors were set up at four locations in eight general areas within representative, potential microchiropteran bat habitat in the study area to record echolocation calls (Figure 2.1). Calls were recorded over the entire night, with a minimum of four nights at each location. A total of 10 detector nights were surveyed at the four locations. Microbat sonograms were viewed in Analook for Windows (Corben 2011).

2.3.7 Targeted nocturnal bird and mammal surveys

Spotlight searches were carried out, principally for threatened and other nocturnal mammal, bird and frog species within the study area, though opportunistic sightings of other nocturnal fauna were also recorded.

Nocturnal bird spotlighting surveys commenced at sunset (to capture species emerging from roost sites and hollows) during favourable weather, that is, outside times of extreme wind. Call broadcasting for threatened owl species including the Powerful Owl and Barking Owl was also conducted. The total survey effort for nocturnal birds was 16 person hours.

Motion-sensitive infrared (IR) cameras were placed in four locations throughout the study area (Figure 2.1), for a total of 10 camera trap nights. The camera traps were baited with a sponge soaked in honey and truffle oil, targeting ground-based carnivores and omnivores. Cameras were positioned in identified fauna runways, often in gullies or in areas where water was available.

In addition to nocturnal spotlight surveys, searches for any evidence of owls (eg pellets, wash on trees and used hollows) were undertaken during searches for signs of fauna. The total survey effort for fauna signs was over 24 person hours.

Nocturnal surveys were conducted over a total of three nights, totalling 16 person hours of survey effort. Where possible, nights with rainfall and greater moon influence were avoided, as they are known to affect spotlight success (DEC 2004).

Opportunistic records of tracks, scats and signs (that indicate mammalian use of an area) were noted while completing other survey tasks. These tracks, scats and signs can sometimes lead to the identification of taxa to the species level and are therefore important presence indicators. A total of over 32 person hours were spent searching for tracks, scats and signs.

2.3.8 Koala spot assessments

Koalas in a socially stable breeding population are known to repeatedly feed on a small number of trees (home range trees). As such, high activity areas can be determined based on the location and distribution of faecal pellets in suitable habitat. The spot assessment technique (SAT) (Phillips and Callaghan 2011) was used to assess the presence and activity level of Koalas in the study area.

Spot assessments were completed at each plot and transect location to determine presence and/or activity levels. A total of 32 person hours was spent searching for habitat signs, specifically Koala pellets, over the survey period.

In accordance with SEPP 44, areas were identified as potential Koala habitat where feed trees listed in Schedule 2 of the SEPP comprised more than 15% of the total number of trees in the upper or lower strata of the canopy layer. Habitat assessments were also undertaken for Koalas in these locations.

2.4 Aquatic assessment

The aquatic assessment utilised a combination of desktop research and field survey.

The desktop research included studying the Key Fish Habitat maps (DPI no date) to determine the potential presence of such habitat in the study area. Strahler stream order was also mapped for all streams intersecting the study area.

A field survey was completed by JSA Environmental for both the rail project and the Hume Coal Project, which involved surveys proximal to the road and rail crossings associated with the rail project. Habitat assessments were completed proximal to the project area at four sites shown in Figure 2.1. All crossings were inspected to determine if fish habitat (ie water, snags, pools, runs and rocky substrates) or aquatic vegetation was present.

The document *Policy and Guidelines for Fish Habitat Conservation and Management Update 2013* (DPI 2013) defines four classes of fish habitat in NSW, as listed in Table 2.5.

Table 2.5 Classification of waterways for fish passage

Classification	Characteristics of waterway class
Class 1 major key fish habitat	Marine or estuarine waterway or permanently flowing or flooded freshwater waterway (eg river or major creek), habitat of a threatened or project fish species or critical habitat.
Class 2 moderate key fish habitat	Non-permanently flowing (intermittent) stream, creek or waterway (generally named) with clearly defined bed and banks with semi-permanent to permanent waters in pools or in connected wetland areas. Freshwater aquatic vegetation is present. Type 1 and 2 habitats are present.
Class 3 Minimal key fish habitat	Named or unnamed waterway with intermittent flow and sporadic refuge, breeding or feeding areas for aquatic fauna (eg fish, yabbies). Semi-permanent pools form within the waterway or adjacent wetlands after a rain event. Otherwise, any minor waterway that interconnects with wetlands or other Class 1-3 fish habitats.
Class 4 Unlikely fish habitat	Waterway (generally unnamed) with intermittent flow following rain events only, little or no defined drainage channel, little to no flow or free standing water or pools post rain events (eg dry gullies or shallow floodplain depressions with no aquatic flora present).

Fish habitat in the vicinity of project roads and rail creek crossings was classified in accordance with the above table, and with consideration of the Key Fish Habitat maps, stream order, and JSA Environmental and EMM field surveys. The preferred waterway crossings for fish habitats were identified based on the class of fish habitat, in accordance with Table 3 of DPI (2013).

A habitat assessment was also completed for the Macquarie Perch (*Macquaria australasica*), which is listed as an endangered species under the *Fisheries Management Act 1994* (FM Act) and the EPBC Act, as it has been previously recorded in the Wingecarribee LGA.

3 Existing environment

3.1 Overview

The project is in an area that has a long history of grazing. The majority of the disturbance footprint is characterised by exotic pasture. Some larger patches of native vegetation occur; however, many are small and highly fragmented. The remaining patches of native vegetation are currently in use for grazing and have a highly degraded understorey. Consequently, native vegetation in the study area exists as native canopy trees with an exotic understorey.

The following sections describe the results of database searches, and the outcomes of field survey in relation to landscape features, plant community types, and ecosystem and species credit species in the study area. This chapter also summarises the impacts requiring offsetting, avoidance, minimisation and offsetting measures.

3.2 Database search results

A search of the BioNet Atlas of NSW Wildlife (OEH 2016b) indicated that 10 threatened flora, 11 bird and 5 mammal species listed under the TSC Act have been previously recorded in a 10 km radius of the study area.

A search of the Commonwealth Protected Matters Search Tool (DoE 2013) for MNES under the EPBC Act indicated that 4 TECs, 14 threatened plant, 6 bird, 3 frog, 8 mammal, 1 reptile and 7 terrestrial migratory bird species may occur within 10 km of the study area.

The study area is within the Moss Vale IBRA (Interim Biogeographic Regionalisation of Australia) sub-region (refer to the figures in Appendix E). There have been eight TECs listed under the TSC Act recorded in the IBRA sub-region. These communities and their conservation status are provided in Table 3.1.

Table 3.1 Threatened ecological communities in the Moss Vale IBRA subregion and identified in the Protected Matters Search Tool

Community name	TSC Act conservatioy status	EPBC Act conservation status
Southern Highlands Shale Woodland in the Sydney Basin Bioregion (TSC Act) and Southern Highlands Shale Forest and Woodland in the Sydney Basin Bioregion (EPBC Act)	E	CE
Montane Peatlands and Swamps of the New England Tableland, NSW North Coast, Sydney Basin, South East Corner, South Eastern Highlands and Australian Alps Bioregions (TSC Act) and Temperate Highland Peat Swamps on Sandstone (EPBC Act)	E	E
Tableland Basalt Forest in the Sydney Basin and South Eastern Highlands Bioregions	E	E
Tableland Snow Gum, Black Sallee, Candlebark and Ribbon Gum Grassy Woodland in the South Eastern Highlands, Sydney Basin, South East Corner and NSW South Western Slopes Bioregions	E	-
Mount Gibraltar Forest in the Sydney Basin Bioregion (TSC Act) and Upland Basalt Forests of the Sydney Basin Bioregion (EPBC Act)	E	E
Robertson Basalt Tall Open Forest in the Sydney Basin Bioregion (TSC Act) and Upland Basalt Forests of the Sydney Basin Bioregion (EPBC Act)	E	E
Coastal Upland Swamps in the Sydney Basin Bioregion	E	-

Notes: 1. TSC Act – Threatened Species Conservation Act 1995, EPBC Act – Environment Protection and Biodiversity Conservation Act 1999, E – endangered ecological community, CE - critically endangered ecological community.

3.3 Landscape features

Landscape features of the project area and surrounds are shown on the overview site map (Figure 3.1) and overview location map (Figure 3.2). The FBA requires that the site map is at a 1:1,000 scale and the location map is at the 1:10,000 scale. Due to the large size of the project area, an overview site and location map has been made to summarise all landscape features. Individual site and location maps are provided in Appendix E, in strict accordance with the mapping scale requirements of the FBA.

The majority of the study area is on the Moss Vale Highlands Mitchell landscape, with a small area of the Nattai Plateau Mitchell landscape near Berrima Road. The study area is within the Sydney Basin IBRA bioregion and Moss Vale IBRA sub-region.

As the project is a linear development, the native vegetation extent was assessed within a buffer area by calculating the centreline of the direct disturbance footprint (preferred option) using a geographic information system (GIS). A 550 m buffer was then placed on each side of the centreline. The area and the perimeter of native vegetation were has been assessed in the buffer area prior to and following development (Figure 3.1 and Figure 3.2) for the preferred and alternative option. A regionally significant biodiversity link is present at the western end of the buffer area; however, it will not be affected by the project.

The preferred and alternative options have the same area and perimeter of native vegetation. There is no proportional change in the native vegetation to perimeter ratio following development for both options, as summarised in Table 3.2.

Table 3.2 Native vegetation extent prior to and following development

Factor	Prior to development	Following development
Buffer area	1215	1215
Native vegetation cover in the buffer area (ha)	140	138
Native vegetation perimeter (m)	55,414.20	51,797
Native vegetation divided by perimeter	0.002	0.002
Native vegetation to perimeter ratio	1	1

3.4 Streams and aquatic habitat

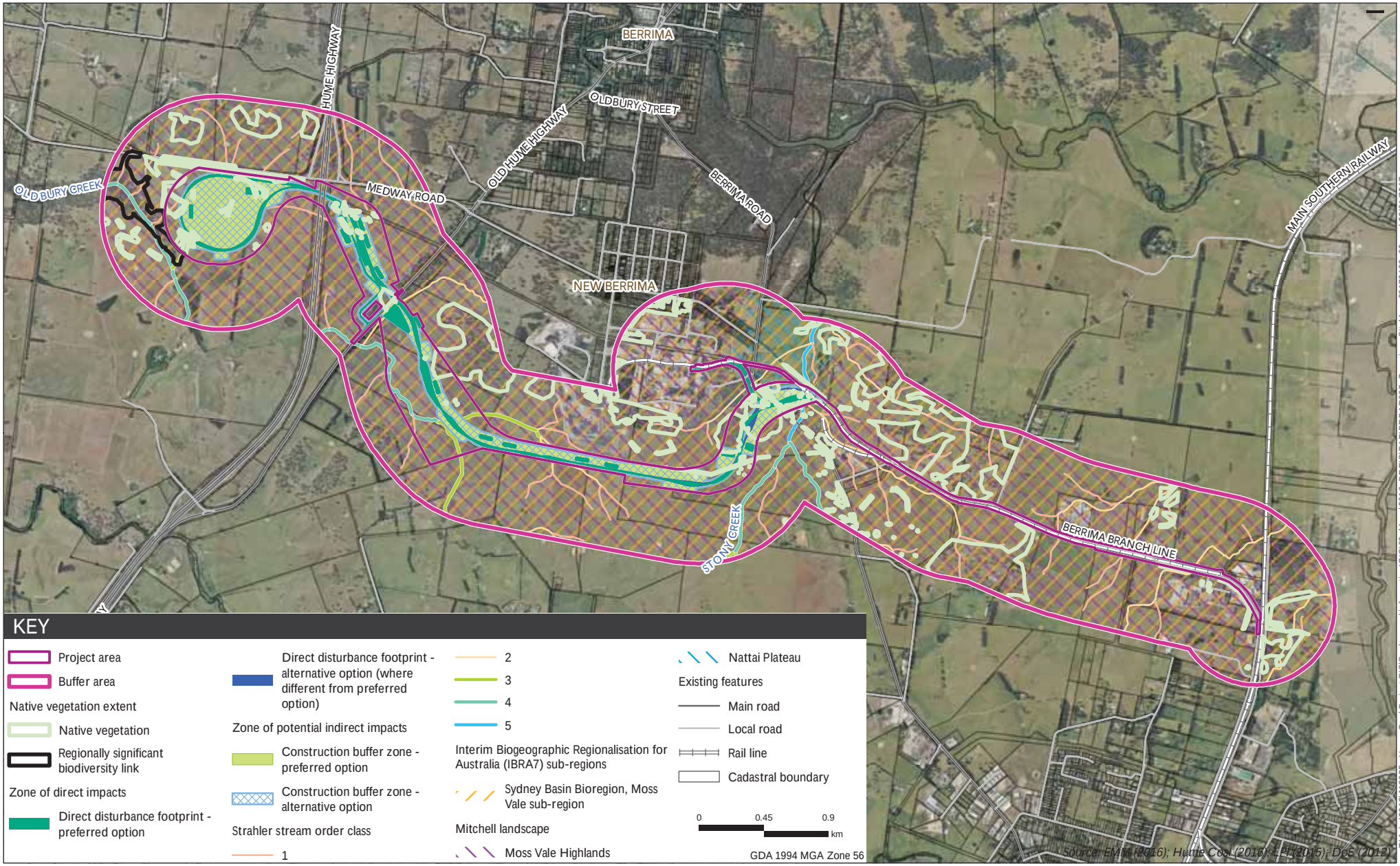
Two streams and minor drainage lines intersect the study area. These streams and their Strahler Order are summarised in Table 3.3. Rivers and streams are shown on Figure 3.1 and Figure 3.2. There are no wetlands in the study area.

Table 3.3 Streams in the study area and their Strahler order

Stream name	Strahler order
Stony Creek	1, 2, 4, 5
Oldbury Creek	1, 2, 3, 4

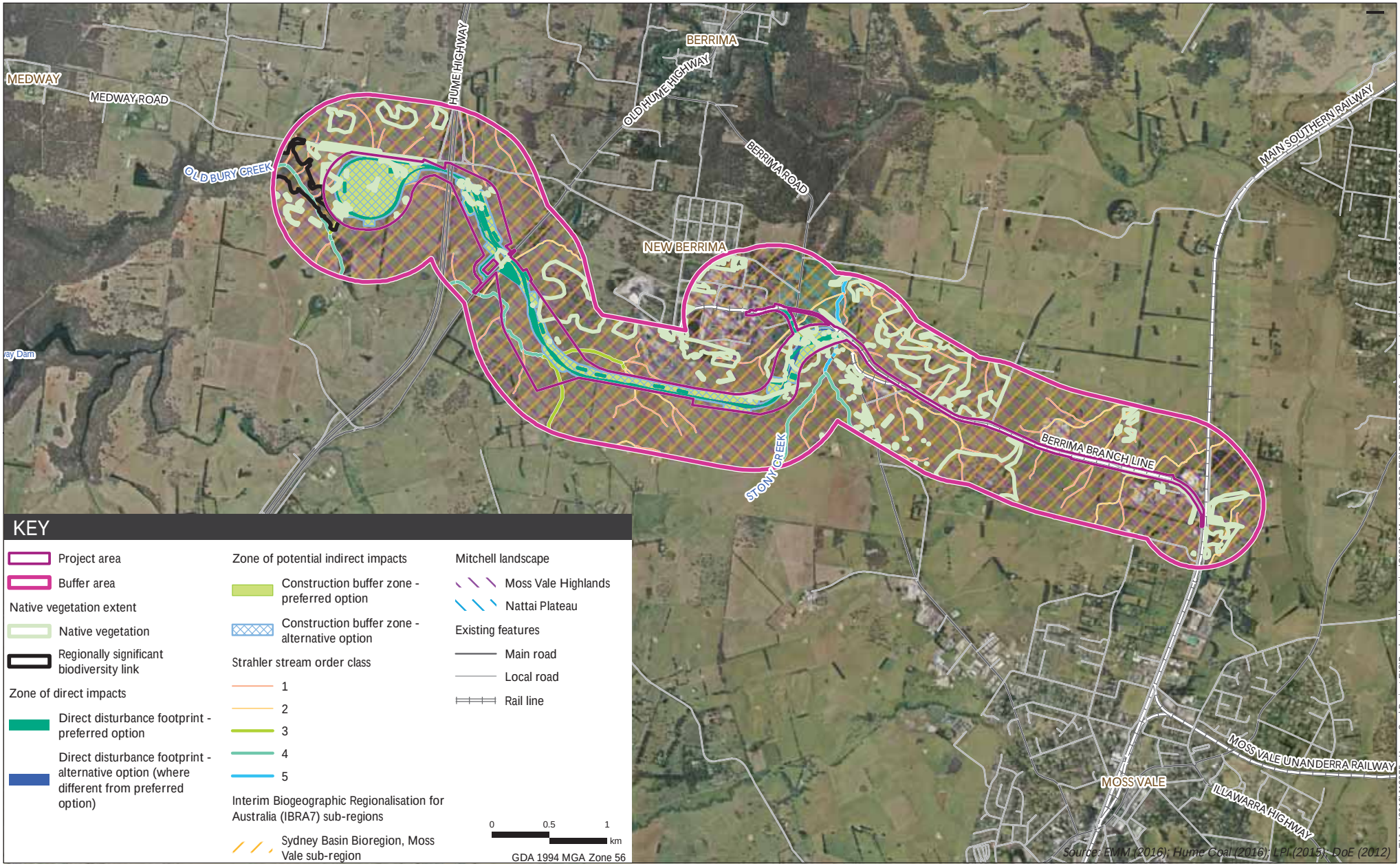
Notes: 1. Source: Strahler (1995).

Stony Creek and Oldbury Creek are identified on the Key Fish Habitat map for Wingecarribee LGA (DPI no date), and shown on Figure 3.3.



Site map - overview

Berrima Rail Project
Biodiversity assessment report
Figure 3.1



Location map - overview

Berrima Rail Project

Biodiversity assessment report

Figure 3.2

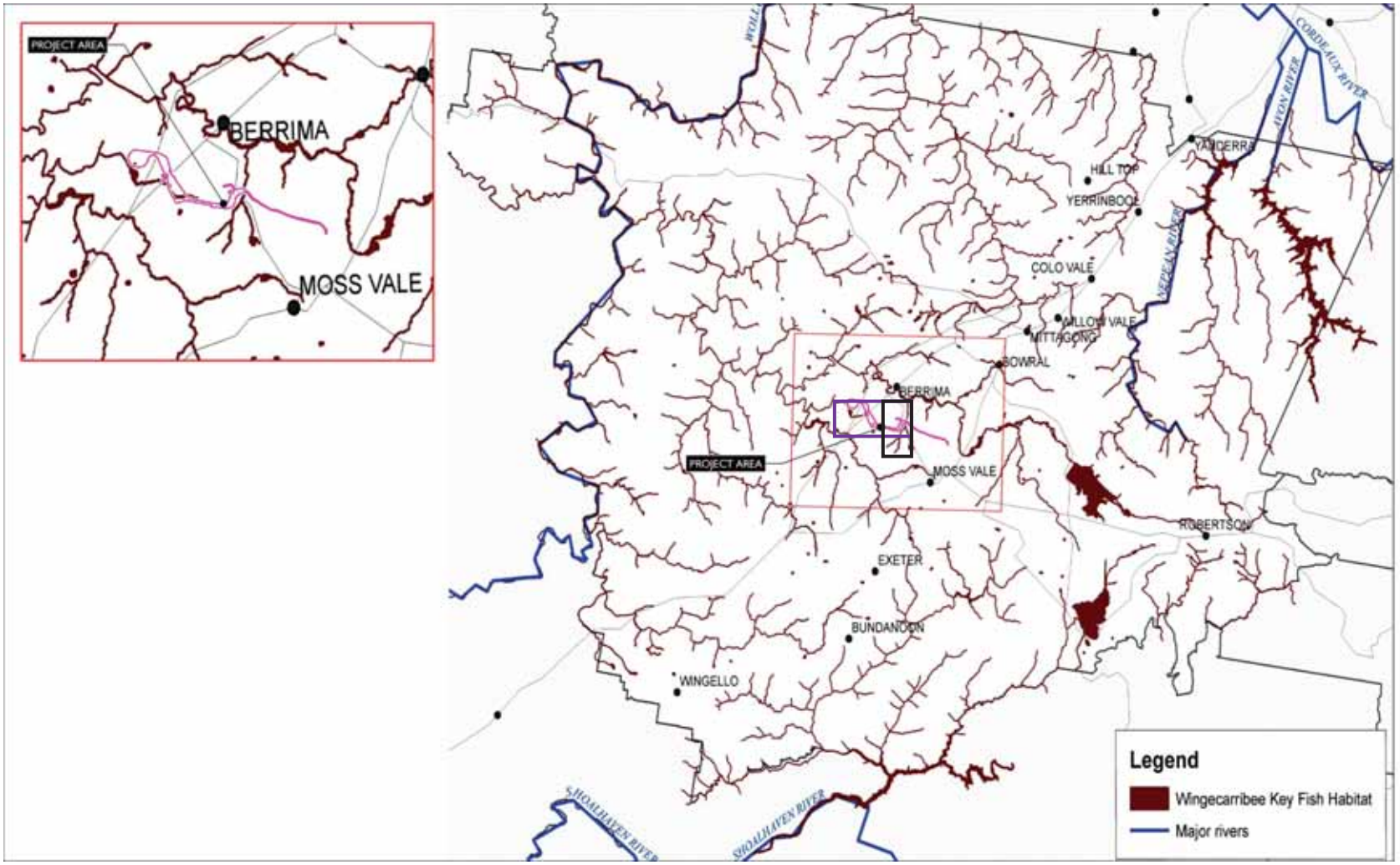


Figure 3.3 **Mapped key fish habitats (Stony Creek indicated by black box, Oldbury Creek indicated by purple box)**

The project area intersects Stony Creek at Berrima Road, Oldbury Creek and its tributaries south of the Berrima Cement Works, and a tributary of Oldbury Creek south of the Old Hume Highway crossing and in the rail loop. These crossings are shown in Photographs 3.1 to 3.4.

Photograph 3.1 **Stony Creek at the intersection with Berrima Road (left) and dam (right)**

Photograph 3.2 **Oldbury Creek (left) and its tributary (right), southwest of the Berrima Cement Works**

Photograph 3.3 **Drainage depression alongside the Old Hume Highway**

Photograph 3.4 **Ephemeral tributary of Oldbury Creek approximately south west of the rail loop**

The small dam on Stony Creek (Photograph 3.1), which is upstream of a larger dam, had a water height of up to 0.5 m during the survey. It had a smooth earth substrate with no snags or other fish habitat features or aquatic vegetation present. Although Stony Creek contains permanent water upstream of the Berrima Road Crossing, it has been dammed to the north of Berrima Road, and therefore is not connected to the Wingecarribee River. This dam would therefore prevent fish passage to the small dam on Stony Creek, and as such the waterway is likely to only provide habitat for common reptiles including the Eastern Snake-necked Turtle (*Chelodina longicollis*) and Yabby (*Cherax destructor*).

The tributaries of Oldbury Creek (Photograph 3.2 and 3.3) did not contain water during the survey. They consist of a shallow depression (less than 0.05 m) where water may flow after rainfall and do not contain aquatic vegetation. The ephemeral tributary of Oldbury Creek south west of the rail loop (Photograph 3.4) did not contain any water or aquatic vegetation, however some embedded surface rocks were present. Similar to the Oldbury Creek tributaries, Oldbury Creek in this location has a poorly defined and shallow channel where water may flow after rainfall.

Although Oldbury Creek and some of its tributaries are identified on the Key Fish Habitat map for Wingecarribee LGA (Figure 3.3), they do not contain key fish habitat. DPI (2013) defines key fish habitats as areas that are crucial to the survival of native fish stocks. The term excludes man-made habitats, such as agricultural drains and off-stream dams and ponds, and those natural waterways which are dry for the majority of the time or have limited habitat value. Streams intersecting the project area have been heavily modified by agricultural activities and the creation of upstream dams. These streams are dry most of the time, even though discharges from the Berrima Sewerage Treatment Plant are relatively constant.,Therefore, these streams do not represent key fish habitats as defined by DPI (2013).

Based on the findings of the field survey, these drainage lines have been classified as Class 4 - unlikely fish habitat (refer to Table 2.5) as they are waterways with intermittent flow following rain events only, with little or no defined drainage channel, and little to no flow or free standing water or pools post rain events (ie dry gullies or shallow floodplain depressions with no aquatic flora present). Although the dam on Stony Creek has standing water and is on a minor waterway, it does not connect with any wetlands or Class 1 to 3 fish habitats and flow to the Wingecarribee River is impeded by the dam wall. Therefore, the dam on Stony Creek and upstream sections has been classified as Class 4 unlikely fish habitat.

Streams intersecting the study area do not contain habitat for the Macquarie Perch. The *Draft Referral Guidelines for the Macquarie Perch* (SEWPaC 2011b) states that to provide habitat for the species, streams must contain:

- deep, rocky pools;
- clear water interspersed with riffles;
- slow to fast flowing water bodies; and
- ample cover from rocks, overhanging banks, logs, branches, emergent and submerged aquatic plants, trailing bank vegetation, stumps and clay banks.

The streams intersecting the study area do not have these habitat characteristics, and therefore do not provide habitat for the Macquarie Perch.

Wetlands and national parks are absent from the study area and surrounds.

3.5 Plant community types

Two native and one exotic vegetation community were recorded in the study area, comprising:

- Broad-leaved Peppermint Narrow-leaved Peppermint grassy woodland;
- Snow Gum Woodland; and
- Cleared land.

Descriptions of the vegetation communities and their plant community types (PCT) are provided in Table 3.4 and illustrated in Figure 3.4. Plot data is provided in Appendix A.

Table 3.4 Vegetation communities in the study area

Vegetation community	Dominant canopy species[1]	Plant community type (PCT)	Dominant midstorey species[1]	Dominant understorey species[1]	Landscape position and soils
Broad-leaved Peppermint Narrow-leaved Peppermint grassy woodland	Broad-leaved Peppermint (*Eucalyptus dives*), Narrow-leaved Peppermint (*E. radiata*), Paddys River Box (*E. macarthurii*)	PCT 731 Broad-leaved Peppermint - Red Stringybark grassy open forest on undulating hills, South Eastern Highlands Bioregion	None	Kikuyu (*Pennisetum clandestinum**), Finger Grass (*Dactyloctenium radulans*), Cocksfoot (*Dactylis glomerata**) and Lambs Tongues (*Plantago lanceolata**).	Occurs on gently undulating land at approximately 700 m above sea level (ASL) on deep shale soils.
Snow Gum woodland	Snow Gum (*E. pauciflora* subsp. *pauciflora*)	PCT 1191 Snow Gum - Candle Bark woodland on broad valley flats of the tablelands and slopes, South Eastern Highlands Bioregion	None	Glossy Nightshade (*Solanum americanum*), Basket Grass, Tussock Grass (*Poa labillardieri*), *Rytidosperma racemosum* var. *racemosum,* Spiny-headed Mat Rush, Catsear (*Hypochaeris radicata**), Cocksfoot and Serrated Tussock (*Nassella trichotoma**).	Occurs in frost hollow flats and footslopes in undulating tableland areas between 600 and 1100 m ASL.
Cleared land	None	N/A	None	Paddock Lovegrass (*Eragrostis leptostachya*), Catsear, Hairy Hawkbit (*Leontodon taraxicoides**), Subterranean Clover (*Trifolium subterraneanum**), Couch (*Cynodon dactylon*), Perennial Ryegrass (*Lolium perenne**), Paspalum (*Paspalum dilatatum**) and Kentucky Bluegrass (*Poa pratensis**).	Occurs on undulating land from 650-700 m ASL on clay loam soils.

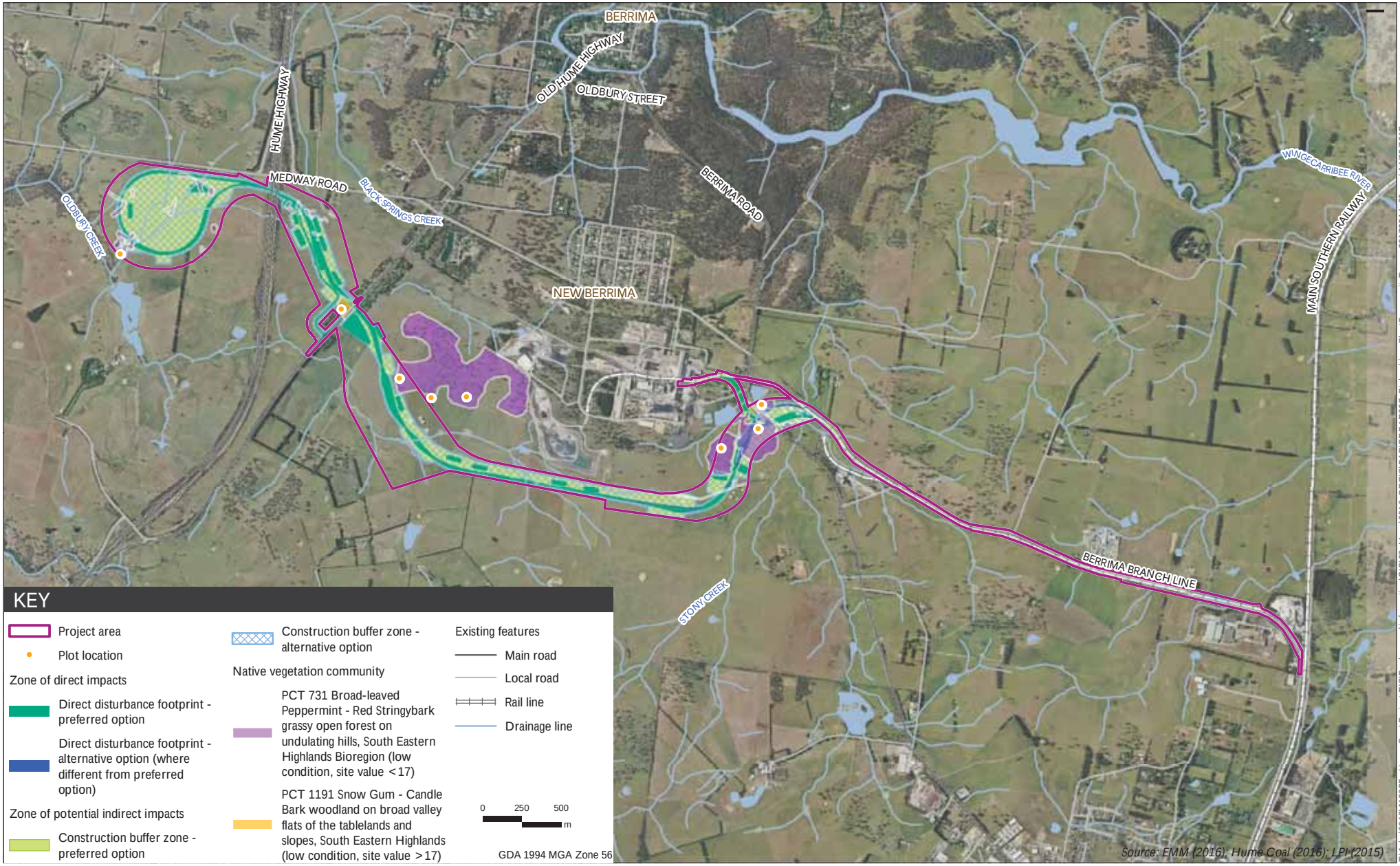
Notes: *1. Dominant species are those that have a high projected foliage cover, or those that are present across most vegetation sampling points.*

*2. *denotes introduced species.*

3.6 Threatened ecological communities

The vegetation communities recorded in the study area were compared to the final determinations for the eight TECs that occur in the Moss Vale IBRA sub-region. The Broad-leaved Peppermint Narrow-leaved Peppermint grassy woodland has some representative species of 'Southern Highlands Shale Woodland in the Sydney Basin Bioregion', which is listed as an endangered ecological community (EEC) under the TSC Act. The Snow Gum Woodland has a representative canopy species of 'Tablelands Snow Gum, Black Sallee, Candlebark and Ribbon Gum Grassy Woodland in the South Eastern Highlands, Sydney Basin, South East Corner and NSW South Western Slopes Bioregions; which is listed as an EEC under the TSC Act.

A comparison of vegetation communities in the study area to these two listed communities is provided in the following sections. These communities did not contain representative species of the remaining TECs previously recorded in the Moss Vale IBRA subregion and therefore were not considered further.



Plant community types

Berrima Rail Project

Biodiversity assessment report

Figure 3.4

3.6.1 Southern Highlands Shale Woodland in the Sydney Basin Bioregion

The final determination for Southern Highlands Shale Woodland in the Sydney Basin Bioregion (OEH 2011) states that it ranges in structure from open forest to woodland and scrub, though is predominantly a woodland. Typical tree species in the listed community comprise Narrow-leaved Ironbark, Paddys River Box, Snow Gum, White Stringybark (*E. globoidea*), Monkey Gum (*E. cypellocarpa*), White-topped Box (*E. quadrangulata*), Cabbage Gum (*E. amplifolia*) and Swamp Gum (*E. ovata*). Other trees can include Gully Gum (*E. smithii*), Messmate (*E. obliqua*), Brown Barrel (*E. fastigata*), Ribbon Gum (*E. viminalis*), River Peppermint (*E. elata*), Grey Gum (*E. punctata*), Forest Red Gum (*E. tereticornis*), Brittle Gum (*E. mannifera*) and Argyle Apple (*E. cinerea*).

Southern Highlands Shale Woodland in the Sydney Basin Bioregion contains a variety of small trees including Blackwood (*Acacia melanoxylon*), Two-veined Hickory (*A. binervata*), Sweet Pittosporum (*Pittosporum undulatum*) and shrubs including Native Indigo (*Indigofera australis*), Prickly Beard-heath (*Leucopogon juniperinus*), *Olearia microphylla* and Blackthorn (*Bursaria spinosa*). Groundcovers can include Kangaroo Grass (*Themeda australis*), Longhair Plumegrass (*Dichelachne crinita*) and Weeping Meadow Grass (*Microlaena stipoides*).

The community occurs on clay soils derived from Wianamatta Shale on the Southern Highlands between 600 to 800 m ASL. Disturbed remnants are considered to form part of the community including areas where the vegetation would respond to assisted natural regeneration, because the natural soil and associated seedbank is still at least partially intact.

Broad-leaved Peppermint Narrow-leaved Peppermint grassy woodland was compared to the final determination for Southern Highlands Shale Woodland in the Sydney Basin Bioregion given the presence of some representative canopy species. Although representative canopy species are present (ie Narrow-leaved Peppermint, Paddys River Box and Cabbage Gum), a native midstorey is absent and the understorey is dominated by exotic grass and forb species. The sparse native groundcovers present (ie Rats-tail Grass (*Sporobolus creber*) and Finger Grass (*Dactyloctenium radulans*)) which are disturbance-tolerant species, while characteristic disturbance-sensitive groundcovers including Kangaroo Grass (*Themeda australis*) are absent. The area has a long history of grazing, and is currently in use for cattle grazing purposes. The grass height across much of the community was often less than 0.1 m in height, indicating high grazing pressure. Given the long history of disturbance it is unlikely that the soil profile and seedbank are intact.

Although some representative canopy species are present, the Broad-leaved Peppermint Narrow-leaved Peppermint grassy woodland in the study area does not represent the EEC Southern Highlands Shale Woodland in the Sydney Basin Bioregion as:

- a native midstorey is absent;
- the understorey is exotic-dominated; and
- the soil profile and seedbank are unlikely to be intact given the long disturbance history.

3.6.2 Tablelands Snow Gum, Black Sallee, Candlebark and Ribbon Gum Grassy Woodland in the South Eastern Highlands, Sydney Basin, South East Corner and NSW South Western Slopes Bioregions

Tablelands Snow Gum, Black Sallee, Candlebark and Ribbon Gum Grassy Woodland in the South Eastern Highlands, Sydney Basin, South East Corner and NSW South Western Slopes Bioregions typically occurs as an open forest, woodland or open woodland that grades into grassland. Representative canopy species comprise Snow Gum, Black Sallee (*E. stellulata*), Candlebark (*E. rubida*) and Ribbon Gum. Other eucalypts including Black Gum and Small-leaved Gum (*E. parvula*) occur infrequently.

A shrub layer comprising Tree Violet (*Hymenanthera dentata*) and Urn Heath (*Melichrus urceolatus*) may be present. The understorey is dominated by grasses and herbs including Kangaroo Grass, Tussock Grasses (*Poa* spp.), Speargrasses (*Austrostipa* spp.), Wallaby Grasses (*Rytidosperma* spp.), Scaly Buttons (*Leptorhynchos squamatus*), Yellow Buttons (*Chrysocephalum apiculatum*) and Common Woodruff (*Asperula conferta*). The community may also occur as a secondary grassland where dominant trees have been removed but the ground stratum remains. The community occurs on valley floors, the margins of frost hollows, foot slopes and undulating hills between approximately 600 and 1400 m ASL.

Snow Gum Woodland has been compared to the final determination for Tablelands Snow Gum, Black Sallee, Candlebark and Ribbon Gum Grassy Woodland in the South Eastern Highlands, Sydney Basin, South East Corner and NSW South Western Slopes Bioregions. It contains one representative canopy species of the listed community, namely Snow Gum. The understorey was dominated by two noxious weeds, namely Serrated Tussock (*Nassella trichotoma*) and African Lovegrass (*Eragrostis curvula*), and contains other weed species frequently encountered in agricultural environments. The sparse native understorey species present (eg Climbing Saltbush (*Einadia nutans*)) is a disturbance-tolerant species that can persist in heavily grazed areas. The area has a long history of grazing, and is currently in use for cattle grazing purposes.

Although one representative canopy species is present, the Snow Gum Woodland in the study area does not represent the EEC Tablelands Snow Gum, Black Sallee, Candlebark and Ribbon Gum Grassy Woodland in the South Eastern Highlands, Sydney Basin, South East Corner and NSW South Western Slopes Bioregions as:

- the understorey is exotic-dominated; and
- the soil profile and seedbank are unlikely to be intact given the long disturbance history.

No other TECs were recorded in the study area.

3.7 Vegetation zones

Two vegetation zones occur in the study area. A summary of these is provided in Table 3.5 and shown in Figure 3.4. The size and composition of the vegetation zones is consistent across the preferred and alternative options.

Table 3.5 Vegetation zone summary

Vegetation zone	PCT	BVT	Area (ha)	Condition class	Required survey effort	Plots completed
1	731	HN514	1.8	Low	1 plot	6 plots
2	1191	HN589	0.2	Low	1 plot	1 plot

Notes 1. PCT – plant community type, BVT – biometric vegetation type.

3.8 Threatened species

Threatened species identified in and around the project area are illustrated in Figure 3.5. As shown, Paddys River Box is the only threatened species recorded in the study area.

3.8.1 Ecosystem credit species

No ecosystem credit species were predicted by the Biobanking Calculator as related to the plant community types that occur in the study area. Additionally, no ecosystem credit species were recorded in the study area.

Potential habitat is present for the following ecosystem credit species that have previously been recorded near the study area, but were not recorded during the survey (Appendix B):

- Little Eagle;
- Gang-gang Cockatoo;
- Scarlet Robin;
- Flame Robin;
- Powerful Owl; and
- Masked Owl.

3.8.2 Species credit species

The Biobanking calculator predicted that six species credit species may occur in the study area (Table 3.6). The table describes the survey type, if the species was recorded, the species abundance and habitat, the size of the species polygon and if it can withstand further loss.

Table 3.6 Predicted species credit species

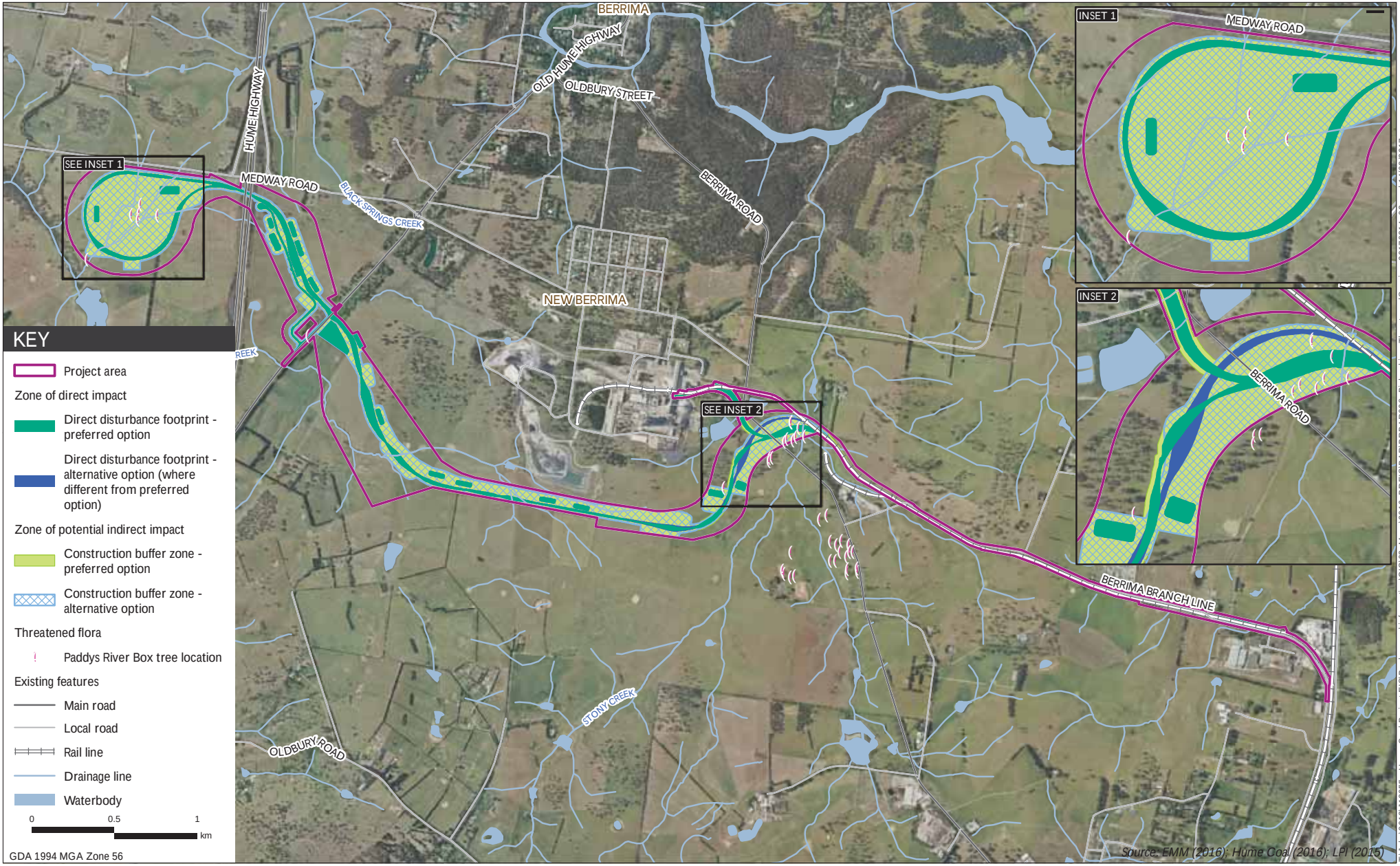
Species credit species	Survey type	Species recorded?	Species abundance in the project area	Habitat in the study area	Species polgyon (ie the area of habitat impacted)	Can the species withstand further loss?[1]
Dwarf Kerrawang	Targeted survey	No	The species is not predicted to occur in the project area as it was not recorded during targeted surveys.	Low likelihood. The Snow Gum Woodland contains potential habitat for the species, however targeted surveys completed throughout this small area (0.2 ha) failed to detect the species.	0	No. Cannot withstand further loss. However, the species is absent from the project area.
Eastern Pygmy Possum *Cercartetus nanus*	Targeted survey	No	The species is not predicted to occur in the project area as it was not recorded during targeted surveys.	None. The study area does not contain heath vegetation with *Banksia* spp. and myrtaceous shrubs.	0	Yes. Up to 10% foraging and 5% breeding habitat. However, the species is absent from the project area.
Hoary Sunray *Leucochrysum albicans* var. *tricolor*	Targeted survey	No	The species is not predicted to occur in the project area as it was not recorded during targeted surveys.	Low likelihood. This species may potentially occur in woodland along roadsides; however they are highly dependent on the presence of bare ground. As the groundcover (native and exotic) in woodland of the study area is dense they are unlikely to occur and were not recorded during targeted surveys.	0	Yes. However, the species is absent from the project area.
Koala	Targeted survey	No	The species is not predicted to occur in the project area as it was not recorded during targeted surveys.	Low likelihood. Although Koalas have been recorded north-east of the study area, this is fragmented from the study area by Berrima Road and the Berrima Branch line. In addition, the fragmented patches of native vegetation only contains a small number of feed tree species (Cabbage Gum) and is dominated by Peppermint species that are not classified as feed trees.	0	Can sustain up to 5% loss in foraging habitat provided clearing does not increase fragmentation.

Table 3.6 Predicted species credit species

Species credit species	Survey type	Species recorded?	Species abundance in the project area	Habitat in the study area	Species polgyon (ie the area of habitat impacted)	Can the species withstand further loss?[1]
Paddys River Box	Targeted survey	Yes	Sixteen individual Paddys River Box were recorded in the study area, with an additional 24 individuals recorded to the south west.	Recorded in the study area, however the design has been modified such that any direct impacts to the species has been minimised for the preferred option and avoided for the alternate option.	1 individual (preferred option only)	No. The species cannot withstand further loss. Only one individual will be removed for the preferred option. Offsets are proposed to compensate for the removal of one tree if the preferred option is selected.
Squirrel Glider	Assumed	N/A	The species abundance is unknown as it was not recorded during surveys.	Moderate likelihood. Large eucalypts containing hollows may provide denning and foraging habitat for the species.	2 ha	Yes. Up to 10% of foraging habitat and 5% of breeding habitat.

Notes: 1. Species that cannot withstand further loss are determined by the Threatened Species Profile Database (OEH 2016).

Only one threatened species was recorded in the study area; Paddys River Box. Sixteen Paddys River Box, a species credit species, were recorded in the study area, with a further 24 individuals recorded south-west of the study area. The Squirrel Glider has a moderate likelihood of occurrence in the study area given the presence of large eucalypts containing hollows. No other species credit species are predicted to occur in the study area.



EMM HUMECOAL

Threatened species

Berrima Rail Project

Biodiversity assessment report

Figure 3.5

4 Preferred and alternative option impact assessment

This chapter describes the impacts requiring offsetting associated with native vegetation clearance for the project and the indirect impacts associated with the construction and operation of the project as a whole. This chapter also assesses the preferred and alternative options.

4.1 Areas that require assessment

The direct disturbance footprint (ie the zone of direct impact shown in Figure 3.1 and Figure 3.2) has been optimised such that direct impacts on native vegetation will be minimised for the preferred and alternative options. Direct impacts on Paddys River Box will be avoided by the alternative option. However, one tree will be removed for the preferred option (see Figure 6.3). Both preferred and alternative options will involve the clearing of approximately 2 ha of native vegetation.

Potential direct impacts to biodiversity include vegetation clearing, loss of fauna and flora habitat, habitat fragmentation, edge and barrier effects, injury and mortality and changed hydrology. The project will directly impact the following vegetation communities and threatened flora species through clearing:

- approximately 1.8 ha of low condition Broad-leaved Peppermint - Red Stringybark grassy open forest on undulating hills, South Eastern Highlands Bioregion (PCT 731);
- approximately 0.2 ha of low condition Snow Gum - Candlebark woodland on broad valley flats of the tablelands and slopes, South Eastern Highlands Bioregion (PCT 1191);
- approximately 2 ha of potential habitat that contains suitable hollow bearing-trees for the Squirrel Glider, a species credit species; and
- removal of one Paddys River Box (preferred option only).

As the two plant communities in the project area contain habitat for threatened species, both communities require assessment in accordance with the FBA.

Potential indirect impacts are discussed in Section 4.3, and the zone of potential indirect impacts is shown in Figure 3.1 and Figure 3.2.

4.2 Matters for further consideration

Matters that require further consideration in accordance with Section 9.2 of the FBA are those that are considered to be complicated or severe. The SEARS have identified impacts to Black Gum, a threatened species and population in the Wingecarribee LGA, as a matter for further consideration in the EIS.

Targeted surveys were completed for Black Gum throughout the study area, however none were detected. There are eight records of Black Gum in the wider area (Figure 4.1). These records could not be confirmed during the field survey as they were located on private property. However, for the purposes of this study, it is conservatively assumed that they are still present. None of these individuals will be directly impacted by the preferred or alternative options as they are located outside the surface infrastructure areas.

No other impacts related to the project meet the thresholds for matters for further consideration in accordance with Section 9.2.1.3 of the FBA.

Black Gum records in the locality

Berrima Rail Project

Biodiversity assessment report

Figure 4.1

4.3 Impacts not assessed under the FBA

4.3.1 Aquatic and riparian environment

The preferred and alternative options intersect the same five streams, comprising:

1. Stony Creek at the Berrima Road intersection;
2. Oldbury Creek south of the Berrima Cement Works;
3. a tributary of Oldbury Creek south of the Berrima Cement Works;
4. a tributary of Oldbury Creek at the intersection with the Old Hume Highway; and
5. the intersection of the ephemeral tributary of Oldbury Creek within the rail loop.

Drainage culverts will be constructed at stream intersections 2 to 5 for the preferred and alternative route options. Although in different locations, culverts will also be installed at the Stony Creek intersection for the preferred and alternative options. Therefore, drainage will be maintained at all the stream intersections.

The streams were not found to contain aquatic vegetation or fish habitat. Therefore, the project will not result in direct impacts (ie removal, disturbance or smothering) or indirect impacts (shading) on aquatic vegetation or habitat. There will be some temporary disturbance of habitat for Eastern Snake-necked Turtles and Yabbies during construction of the drainage culverts at Stony Creek for the preferred or alternative option. These will be managed through the implementation of sediment and erosion controls outlined in Chapter 14 of the EIS (soil and land resources), and aquatic habitat management measures in Section 5.2.

4.3.2 Edge effects

The clearing of native vegetation for the project will only result in minor edge effects given that only two patches will be fragmented, while connectivity with other patches will be retained. Several invasive weeds including African Lovegrass and Serrated Tussock dominate the understorey in the study area. This constitutes the key threatening process (KTP) listed under the TSC Act "Invasion of native plant communities by exotic perennial grasses". As the understorey of native vegetation in the study area is dominated by exotic species, the potential for new weed species to invade following clearing for the project is low, and additional mitigation is not considered necessary.

4.3.3 Fragmentation

Native vegetation in the study area is in a highly fragmented state given its agricultural setting. The alignment of the project has been designed such that further fragmentation is minimised, by the siting of the preferred and alternative options in exotic grassland as much as possible. Further, the project disturbance footprint has been restricted to a 4 m buffer surrounding the rail line to minimise fragmentation impacts.

The project will remove the edge of a larger patch of woodland south-west of the Berrima Cement Works. As only the edge of this patch will be removed, it will not have adverse effects on vegetation connectivity. The project will fragment two larger patches of woodland directly south-west of Berrima Road. These patches will be managed such that edge effects are minimised (refer to Section 5.2).

The existing level of aquatic connectivity will be maintained through the installation of drainage culverts at each stream intersection.

4.3.4 Introduced species

European Rabbit (*Oryctolagus cuniculus*) and Red Fox (*Vulpes vulpes*) scats were recorded in the study area. These pest species can spread into new areas and compete with native species with the creation of new linear developments that fragment large tracts of native vegetation and increase the ease of access for these species. However, given the project's agricultural setting and the poor condition and fragmentation of vegetation; the project is unlikely to increase opportunities for such species.

4.3.5 Noise

The study area is bisected by Berrima Road, the Berrima Branch Line, the Hume Highway and the Old Hume Highway and bounded by Medway Road. The area has high levels of existing traffic noise which can be a deterrent to native fauna species. The minor clearance of native vegetation and operation of the project will not significantly increase traffic noise (both road and rail) from existing levels in retained areas of native vegetation and fauna habitats. The project will result in up to four train movements per day (in both directions), which would increase noise from existing levels. However, as the project is located between the existing Hume Highway and Berrima Road, fauna in the area are likely to be more tolerant of noise disturbances and are expected to acclimatise to additional noise.

4.3.6 Groundwater dependent ecosystems and riparian vegetation

The interactive map on the Atlas of Groundwater Dependent Ecosystems (BOM 2016) was queried to identify the presence of any groundwater dependent ecosystems in the study area. The atlas reports that the geomorphology of the study area is characterised by a deeply dissected sandstone plateaux, which was confirmed during the survey in the west of the study area, while remaining parts of the study area are characterised by gently undulating agricultural land. It also reports that the watertable is 2 – 20 m below ground level in this area, and that the vegetation has a low potential for groundwater interaction and dependence.

The project will not intersect or take groundwater from underlying systems and there will be no impact to groundwater levels or flow as a result of the project (see Chapter 13 of the EIS). Therefore, the project will not result in any changes or impacts on groundwater availability or groundwater dependent ecosystems.

Riparian vegetation will not be directly impacted by the proposed development. Potential indirect impacts including weed invasion of riparian vegetation along the nearby Wingecarribee River will be managed through the implementation of erosion and sediment control measures (Section 5.2) during the project which will minimise weed invasion.

4.3.7 Protected matters search

A protected matters search tool was completed within a 10 km radius around the study area (DoE 2015). The search tool predicted that this area may contain three TECs, comprising:

- Southern Highlands Shale Forest and Woodland of the Sydney Basin Bioregion;
- Upland Basalt Eucalypt Forests of the Sydney Basin Bioregion; and
- White Box-Yellow Box-Blakely's Red Gum Grassy Woodland and Derived Native Grassland.

The protected matters search tool also predicted that 28 threatened species listed under the EPBC Act may occur in the study area and/or surrounds. Paddys River Box, formerly only listed under the TSC Act, was listed as an endangered species under the EPBC Act on 5 May 2016.

The protected matters search tool predicted that nine terrestrial and wetland migratory birds may occur in the study area.

A discussion of the species identified by the protected matters search, their likelihood of occurrence and potential to be impacted by the project is provided in the following sub-sections.

a. Listed ecological communities

The soils, geology, structure, floristics and location of each vegetation community were compared against the listing advice for each of the TECs predicted to occur by the protected matters search tool (DoE 2015).

In accordance with the *Approved Conservation Advice (including listing advice) for Southern Highlands Shale Forest and Woodland of the Sydney Basin Bioregion* (TSSC 2015), to be considered a matter of national environmental significance under the EPBC Act, areas of the ecological community must meet:

- the key diagnostic characteristics:
    - an open forest or woodland with a canopy dominated by one or more eucalypt species listed in Table 1 of the Approved Conservation Advice (TSSC 2015);
    - has a ground layer including native grasses and/or other herbs;
    - occurs in the Southern Highlands in the Sydney Basin Bioregion;
    - occurs at elevations between 470 to 830 m ASL on clay soils derived from Wianamatta Shale; and
- at least the minimum condition thresholds for moderate quality.

The Broad-leaved Peppermint Narrow-leaved Peppermint grassy woodland community shares similarities with the Southern Highlands Shale Forest and Woodland TEC. It has an open woodland structure with a canopy dominated by Broad-leaved Peppermint and Narrow-leaved Peppermint, listed in Table 1 of the Approved Conservation Advice. Another two species in Table 1 of the Approved Conservation Advice infrequently occur in the study area, namely Paddys River Box and Cabbage Gum. It has a ground layer which comprises a mix of native and exotic grasses. It occurs in the Southern Highlands, and within the required elevations and on shale.

However, Broad-leaved Peppermint Narrow-leaved Peppermint grassy woodland does not meet the key diagnostic characteristics of the listed community because it does not satisfy the minimum condition thresholds for moderate quality. An assessment against condition categories, classes and thresholds for Southern Highlands Shale Forest and Woodland described in the Approved Conservation Advice (TSSC 2015) is presented in Table 4.1.

Table 4.1 Assessment against condition categories, classes and thresholds for Southern Highlands Shale Forest and Woodland (TSSC 2015)

Category and rationale	Thresholds	Assessment
A1. High condition class A larger patch with good quality native understorey	Patch size ≥ 2 ha **And** ≥ 50% of the perennial understorey vegetation cover* is made up of native species **Or** ≥ 30 native understorey species per ha	Although patch size is ≥ 2 ha, the understorey does not contain native perennial understorey species, as it is dominated by annual grasses. It only contains 1 – 2 native grass species per ha. Therefore, it does not meet category A1.
A2. High condition class A patch with very good quality native understorey	Patch size ≥ 0.5 ha **And** ≥ 70% of the perennial understorey vegetation cover is made up of native species	Although patch size is ≥ 0.5 ha, the understorey does not contain native perennial understorey species, as it is dominated by annual grasses. Therefore, it does not meet category A2.
B1. Moderate condition class A patch with good quality native understorey	Patch size ≥ 0.5 ha **And** ≥ 50% of the perennial understorey vegetation cover is made up of native species **Or** ≥ 15 native understorey species per ha	Although patch size is ≥ 0.5 ha, the understorey does not contain native perennial understorey species, as it is dominated by annual grasses. It only contains 1 – 2 native grass species per ha. Therefore, it does not meet category B1.
B2. Moderate condition class A moderate sized patch with connectivity to a native vegetation area, or a mature tree, or a tree with hollows	Patch size ≥ 0.5 ha **And** ≥ 30% of the perennial understorey vegetation cover is made up of native species **And** The patch is contiguous ** with another type of native vegetation remnant (ie any native vegetation where cover in each layer present in dominated by native species) ≥1 ha in area **Or** The patch has at least one tree with hollows per 0.5 ha or at least one large locally indigenous tree (>60cm dbh) per 0.5 ha	Although patch size is ≥ 0.5 ha, the understorey does not contain native perennial understorey species, as it is dominated by annual grasses. The patches are not within 100 m of another type of vegetation remnant with native vegetation in each strata. Patches that are proximal to each other contain the tree component of the community, but do not contain any native herbs, and the understorey is a mix of native and exotic grasses typical of its agricultural setting. All patches contain at least one tree with hollows per 0.5 ha. However, as the understorey does not contain native perennial understorey species as well as hollows, it does not meet category B2.

Notes: *1.dbh – diameter at breast height, * perennial understorey vegetation cover includes vascular plant species of the ground and shrub layers (where present) within a life cycle of more than two growing seasons. The ground layer includes herbs (ie graminoids, forbs and low shrubs [woody plants ≤ 0.5 m high]). Measurements of perennial understorey vegetation cover exclude annuals, cryptogams, leaf litter or exposed soil. **Contiguous means the patch of the ecological community is continuous with, or in close proximity to (within 100 m) to another area of vegetation that is dominated by native species in each vegetation layer present.*

The Snow Gum Black Sallee grassy woodland was also compared to the *Approved Conservation Advice (including listing advice) for Southern Highlands Shale Forest and Woodland of the Sydney Basin Bioregion* (TSSC 2015). Although it contains Snow Gum, it also contains Black Sallee which is recognised in the advice as a contra-indicative species (ie indicates that the community is not present) for the community (TSSC 2015).

Snow Gum Black Sallee grassy woodland was also compared to the listing advice for Upland Basalt Eucalypt Forest of the Sydney Basin Bioregion (TSSC 2011). The study area is in the Sydney Basin Bioregion, and has elevations and mean annual rainfall that may allow this community to occur. The Snow Gum Black Sallee grassy woodland was found on soils derived from basalt or basalt-like structures. However, its dominant canopy species is Snow Gum, which do not form part of the listed community. It does not contain the required canopy species of the threatened ecological community and therefore it does not occur.

Grasslands recorded in the study area are dominated by exotic species and do not meet the criteria for White Box Yellow Box Blakely's Red Gum Derived Native Grassland (TSSC 2006). The trees present are not the required canopy species; therefore this community does not occur and is unlikely to have ever occurred in the study area.

b. Listed flora

The protected matters search tool predicted that 11 listed flora species may occur within the study area. An assessment of the likelihood that these species would occur was completed (Appendix B). The study area contains 16 Paddys River Box trees, listed as an endangered species under the EPBC Act. These individuals are approximately 18-20 m in height. A further 24 individuals were recorded south of the study area, and had a similar height to those individuals in the study area, but appeared to be older. Some mature trees with greater than 1 m diameter at breast height were recorded south of the study area.

The preferred option requires the removal of one Paddys River Box tree, while the alternative option avoids all direct impacts. The closest Paddys River Box to the alternative option is 4 m, and would be protected from inadvertent damage from vehicles and plant during construction and operation by fencing.

Indirect impacts on Paddys River Box including changes to surface water flow regimes were considered for the preferred and alternative options. The conservation advice for Paddys River Box (DoE 2016b) states that the alteration of surface hydrology is a potential threat to the species. Paddys River Box in the study area occurs near to or within drainage lines and therefore is likely to depend on surface flows for a portion of its water requirements.

Existing surface flows will be maintained in all streams where Paddys River Box occurs (Figure 3.5). Seven Paddys River Box trees are present within the area that will be inside the rail loop embankment. Appropriate drainage infrastructure (such as culverts) will therefore be installed within the embankment to ensure that existing overland flow paths through the rail loop area are maintained throughout the life of the project, as described in Section 5.2.

An assessment of significance was completed for potential impacts on Paddys River Box from the preferred and alternative options (Appendix C). The assessment concluded that the project will not result in significant impacts on Paddys River Box, as:

- direct impacts will be largely avoided by the preferred option;
- direct impacts will be completely avoided by the alternative option; and

- indirect impacts will be managed in accordance with the CEMP.

The study area does not contain habitat for any other listed threatened flora species (Appendix B).

c. Listed fauna

The protected matters search tool predicted that habitat may be present for 17 listed fauna species in the study area. An assessment of the likelihood that these species would occur was completed (Appendix B). A farm dam directly adjacent to the study area may contain potential habitat for the endangered Australian Painted Snipe, which was recorded at a farm dam in Berrima in 2010 (OEH 2016b). This assessment is relevant to both the preferred and alternative options.

An assessment of significance (Appendix C) was completed for the endangered Australian Painted Snipe in accordance with *EPBC Act Policy Statement 1.1 Significant Impact Guidelines: Matters of National Environmental Significance* (DoE 2013). The assessment concluded that the project is unlikely to result in a significant impact to the Australian Painted Snipe as:

- direct impacts will not occur as its potential habitat is outside the study area; and
- only a minor increase in indirect impacts (ie light and noise) is expected as part of the project area which contains an existing rail line.

The study area is not predicted to provide habitat for any other listed fauna species (Appendix B).

d. Migratory fauna

An assessment of the likelihood that these species would occur was completed (Appendix B). There is a moderate likelihood that four migratory species, namely the Great Egret (*Ardea alba*), Cattle Egret (*Ardea ibis*), Rainbow Bee-eater (*Merops ornatus*) and Latham's Snipe (*Gallinago hardwickii*) may occur in a low-lying area east of Berrima Road following high rainfall events. This assessment is relevant to both the preferred and alternative options.

An assessment of significance (Appendix C) was completed for migratory species, namely the Rainbow Bee-eater, Great Egret, Cattle Egret and Latham's Snipe, in accordance with *EPBC Act Policy Statement 1.1 Significant Impact Guidelines: Matters of National Environmental Significance* (DoE 2013). The assessment concluded that the project is unlikely to result in a significant impact to the above migratory species as:

- important habitat is absent from the study area and therefore will not be substantially modified;
- the project will not increase the spread of invasive species; and
- the lifecycle of an ecologically significant proportion of the migratory species populations will not be disrupted, as breeding occurs outside the study area.

The study area is not predicted to provide habitat for any other listed migratory species (Appendix B).

e. Wetlands of international importance, world heritage properties and national heritage places

The closest Ramsar wetland is Towra Point Nature Reserve (DoE 2016a), located over 95 km north-east of the study area. The closest waterways to Towra Point Nature Reserve (the Georges and Nepean Rivers) terminate 56 km and 26 km north of the study area in Cataract and East Kangaloon, respectively.

The project will not have any direct or indirect impacts to wetlands of international importance (declared Ramsar wetlands). There is no potential for the project to affect the Ramsar wetland in Towra Point Nature Reserve.

There are no world heritage properties or national heritage places within or adjoining the preferred or alternative options.

4.4 Analysis of results including summary of design impact differences

The preferred and alternative options will result in similar, and minor, impacts to biodiversity. Both options will result in approximately 2 ha of native vegetation clearing and will require the installation of culverts at five different stream intersections. The only difference between the two is that the preferred option requires the removal of one Paddys River Box tree, while the alternative option would avoid all direct impacts to the species.

4.5 Cumulative impacts

The potential cumulative biodiversity impacts have been assessed with the following projects:

- the proposed Hume Coal Project - as previously described in this EIS, Hume Coal is also applying for State significant development consent for an underground coal mine, which will be serviced by the project.

- New Berrima Clay/Shale Quarry – The Austral Brick Company Pty Ltd (Austral) was granted Project Approval for the New Berrima Quarry in July 2012. This approval allowed the extraction of clay/shale from a resource within the Mandurama property, approximately 1.5 km east of New Berrima and 1.5 km north-east of the Berrima Cement Works, for transportation and use principally at Boral's Bowral brick plant. No construction or extraction operations have been undertaken since Project Approval was granted, and Austral recently sought a modification to the original project approval to allow the relocation of the extraction area. The PAC recommended approval to the modification in November 2015. The quarry location is approximately 4 km from the eastern boundary of the project area.

- Green Valley Sand Quarry – Rocla Materials Pty Ltd (Rocla) received approval on 21 June 2013 for the construction and operation of a sand quarry in an area 28 km south-west of Berrima and 14 km north-east of Marulan. The approval allows the extraction of sandstone, dry and wet processing operations and despatch of sand products to markets on the South Coast, Southern Highlands and Sydney. The quarry is not yet operational.

- Sutton Forest Quarry – SEARs for the Sutton Forest Quarry were issued on 7 February 2014. The SSD proposal involves the establishment of a quarry off the Hume Highway, approximately 20 km south-west of Moss Vale, to extract and process up to 1.15 Mtpa of sand from a total resource of approximately 25 million tonnes. A development application and accompanying EIS has not been submitted for the quarry. The cumulative impacts of this development have not been considered as the SEARS were issued greater than two years ago, and a development application has not been lodged.

Cumulative biodiversity impacts have been assessed for the relevant threatened species and communities that occur on each project.

EMM has also completed a biodiversity assessment for the Hume Coal Project. While most impacts to native vegetation and habitat will be avoided by the Hume Coal Project, it will result in minor residual impacts on potential Squirrel Glider habitat. Paddock trees representing potential Squirrel Glider habitat, which have been converted to an effective clearing area of 8.3 ha using the paddock tree calculator will be cleared for the Hume Coal Project and approximately 2 ha of potential habitat will be cleared for the Berrima Rail Project, resulting in a minor cumulative potential habitat loss of approximately 10.3 ha. Species credits have been generated for the Squirrel Glider for both projects, and appropriate offsets will be provided to offset the minor cumulative impact to their potential habitat.

A flora assessment was completed by Cunningham (2010) for the Berrima Shale/Clay Quarry. Cunningham (2010) concluded that no threatened flora species or ecological communities listed under the TSC or EPBC Acts occurred at the site. Therefore, there will be no cumulative impact on threatened flora species and communities between the project and the Berrima Shale/Clay Quarry.

A fauna assessment was completed by Aquila Ecological Surveys (2010) for the Berrima Shale/Clay Quarry. Aquila Ecological Surveys (2010) concluded that no threatened fauna species listed under the TSC or EPBC Acts occurred at the site. Therefore, there will be no cumulative impact on threatened fauna species between the project and the Berrima Shale/Clay Quarry.

A preliminary ecological assessment has been undertaken by Kevin Mills and Associates (2013) and Lesryk (2013) for the proposed Sutton Forest Quarry as part of the Request for SEARs document (RW Corkery 2013). Kevin Mills and Associates (2013) reports six native vegetation types from the Sutton Forest Quarry, namely Peppermint Tall Forest, Sydney Peppermint Forest, Stringybark Forest, Scribbly Gum Woodland, Regrowth Peppermint Forest, and Freshwater Wetland (Swamp). The broad descriptions of these vegetation types were compared to those that occur in the project area, and found to be different. Therefore, there will be no cumulative loss of similar vegetation types between the project and the proposed Sutton Forest Quarry, should it proceed.

Kevin Mills and Associates (2013) also recognise potential hydrological impacts on Montane Peatlands and Swamps endangered ecological community, occurring north of the proposed Sutton Forest Quarry. As Montane Peatlands and Swamp endangered ecological community is absent from the project area and surrounds, and no groundwater will be accessed for the project, no cumulative impacts on this community will occur.

Kevin Mills and Associates (2010) completed a Flora and Fauna Assessment for the proposed Green Valley Sand Quarry. Similar vegetation types were reported as for the proposed Sutton Forest Quarry (Kevin Mills and Associates 2013), which are different to the vegetation communities of the project area, and therefore no cumulative loss of similar vegetation types will occur. Kevin Mills and Associates (2010) recorded three threatened flora species, namely Paddys River Box, Mountain Swamp Gum (*Eucalyptus aquatica*) and Dwarf Phyllota (*Phyllota humifusa*) at the proposed Green Valley Sand Quarry.

While Paddys River Box occurs within the project area, none of these individuals will be impacted by the design for the alternative option, while one would be impacted for the preferred option. Therefore, if the alternate option is selected, there will be no cumulative loss of Paddys River Box between the project and the proposed Green Valley Sand Quarry. However, if the preferred option is selected, there will be a cumulative impact in the loss of one additional Paddys River Box tree.

The same threatened fauna species were recorded by Kevin Mills and Associates (2010) as mentioned above for the proposed Sutton Forest Quarry (Kevin Mills and Associates 2013), with the exception of the Glossy Black Cockatoo. The Squirrel Glider was also recorded at the proposed Green Valley Sand Quarry, and its area of potential habitat was reported as 46.1 ha. Therefore there will be a minor cumulative impact on Squirrel Glider habitat for the Berrima Rail Project, removing an additional 2 ha of potential habitat.

5 Impact avoidance, minimisation and mitigation

5.1 Impact avoidance and minimisation

The project area is in a predominantly cleared agricultural area. The new rail line has been designed such that the clearing of native vegetation has largely been avoided, and the vegetation to be cleared is in poor condition. In particular, the rail line has been designed such that all direct impacts to the endangered Paddys River Box will be avoided with the exception of the clearance of one individual tree if the preferred option is constructed. As such, impacts on native vegetation and threatened species habitats have been largely avoided.

The project will result in the residual impact of 2.0 ha of native vegetation clearing. This clearing cannot be avoided due to specific alignment requirements and the requirement to meet track design standards. Measures are proposed to mitigate and offset these residual impacts in the following sections.

5.2 Impact mitigation

A construction environmental management plan (CEMP) will be developed and implemented during the construction phase of the project. A number of measures will be incorporated into the CEMP to minimise impacts to biodiversity, as listed in Table 5.1.

Table 5.1 Mitigation measures

Impact	Action	Outcome	Timing	Responsibility
Clearing of threatened flora	Paddys River Box trees to be retained within the project area will be identified and marked to ensure they are avoided during construction	Prevention of inadvertent clearing	Prior to the construction commencing	Hume Coal Environmental Coordinator
Clearing of native vegetation and fauna habitats	A ground disturbance permit system will be developed that will be implemented for all clearing activities.	Prevention of inadvertent clearing	During development of the CEMP, implementation prior to clearing	Hume Coal Environmental Manager
	A pre-clearing inspection will be completed to mark all hollow-bearing trees to be removed in the disturbance footprint, for later management during construction.	All hollow-bearing trees to be removed in the disturbance footprint will be marked for later management during construction	Before vegetation clearing	Hume Coal Environmental Coordinator
	Felling of hollow-bearing trees in the project area will follow a two-stage clearing protocol, whereby surrounding non-hollow vegetation is cleared 24 hours prior to the hollow trees to allow fauna time to move.	Hollow-dependent fauna are given the opportunity to self-relocate, avoiding handling stress	Before and during vegetation clearing	Hume Coal Environmental Manager

Table 5.1 Mitigation measures

Impact	Action	Outcome	Timing	Responsibility
	A suitably trained and experienced ecologist or fauna handler will be present during hollow-bearing tree clearing to rescue and relocate displaced fauna.	Hollow-dependent fauna are rescued and relocated safely	During vegetation clearing	Hume Coal Environmental Coordinator
Erosion and sedimentation	Erosion and sedimentation control measures will be implemented in accordance with the measures outlined in Chapter 14 of the EIS.	Minimisation of indirect impacts from erosion and sediment transport offsite (ie increased weed growth)	Before and during vegetation clearing, during project operation	Hume Coal Environmental Coordinator
	Appropriate drainage infrastructure (such as culverts) will be installed within the rail loop embankment to ensure that existing overland flow paths through the rail loop area are maintained throughout the life of the project.	Avoid the potential risk of impact on Paddys River Box within the rail loop through the alteration of surface water flows	During detailed design and construction	Hume Coal Mine Designer Hume Coal Environmental Manager
Weed invasion	Weed management control measures will be implemented	Minimise weed growth	During construction	Hume Coal Environmental Coordinator

6 Biodiversity credit report

A Biodiversity Credit Report was produced using data collected in accordance with the FBA. This data was entered into the Credit Calculator Version 4.0 for Major Projects. The credits required are summarised below, while the credit report is provided in Appendix F.

No ecosystem credit species were identified by the Biobanking Calculator; however several ecosystem species previously recorded within 10 km of the study area were identified (Little Eagle, Gang-gang Cockatoo, Scarlet Robin and Flame Robin) and therefore the calculations have been adjusted to reflect the species with the highest offset multiplier. The species associated with both PCTs and the highest threatened species multiplier were the Masked Owl and Powerful Owl, with an offset multiplier of three (Table 6.1).

A total of six ecosystem credits are required to compensate for the project's impacts on native vegetation communities and threatened species habitats (Table 6.1).

Table 6.1 Ecosystem credits required

Vegetation zone	PCT	Area (ha)	EEC	Loss in site value score	Current site value score	Ecosystem credit species with the highest multiplier	Credits required to offset impact
1	Broad-leaved Peppermint - Red Stringybark grassy open forest on undulating hills, South Eastern Highlands Bioregion	1.8	No	3.5	12.32	Masked Owl, Powerful Owl	0
2	Snow Gum - Candle Bark woodland on broad valley flats of the tablelands and slopes, South Eastern Highlands Bioregion	0.2	No	3.5	46.35	Masked Owl, Powerful Owl	6
	Total ecosystem credits required						6

It is noted that no credits are required for Broad-leaved Peppermint - Red Stringybark grassy open forest on undulating hills, South Eastern Highlands Bioregion. This is because the current site value score is 12.32, and vegetation with a site value score of less than 17 does not require offsetting in accordance with Section 5.3.1.5 of the FBA (OEH 2014). In addition, offsets are not required for cleared land. Therefore, the only vegetation to be offset is the Snow Gum - Candlebark woodland on broad valley flats of the tablelands and slopes, South Eastern Highlands Bioregion, and the ecosystem credit species it provides potential habitat for. The ecosystem credits to be offset are shown in Figure 6.1, while areas that do not need to be offset are shown in Figure 6.2.

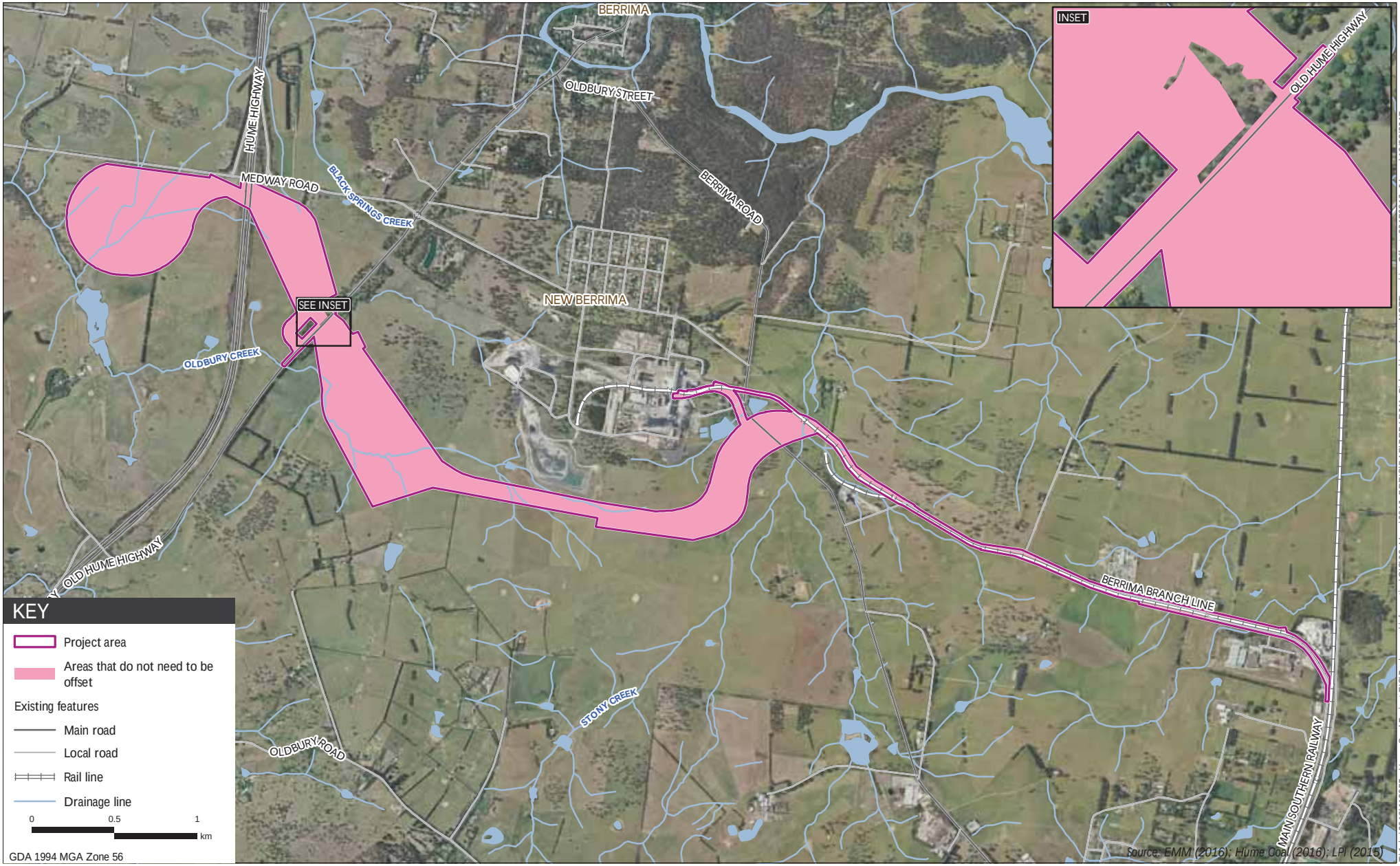
A total of 44 species credits are required to compensate for the project's impacts on potential habitat for the Squirrel Glider. If the preferred option is adopted, 14 species credits will be required for Paddys River Box (Table 6.2). The area of Squirrel Glider habitat to be offset is the 0.2 ha of the Snow Gum - Candlebark woodland on broad valley flats of the tablelands and slopes, South Eastern Highlands Bioregion and the 1.8 ha of Broad-leaved Peppermint - Red Stringybark grassy open forest on undulating hills, South Eastern Highlands Bioregion, and is shown in Figure 6.3.

Ecosystem credits to be offset

Berrima Rail Project

Biodiversity assessment report

Figure 6.1

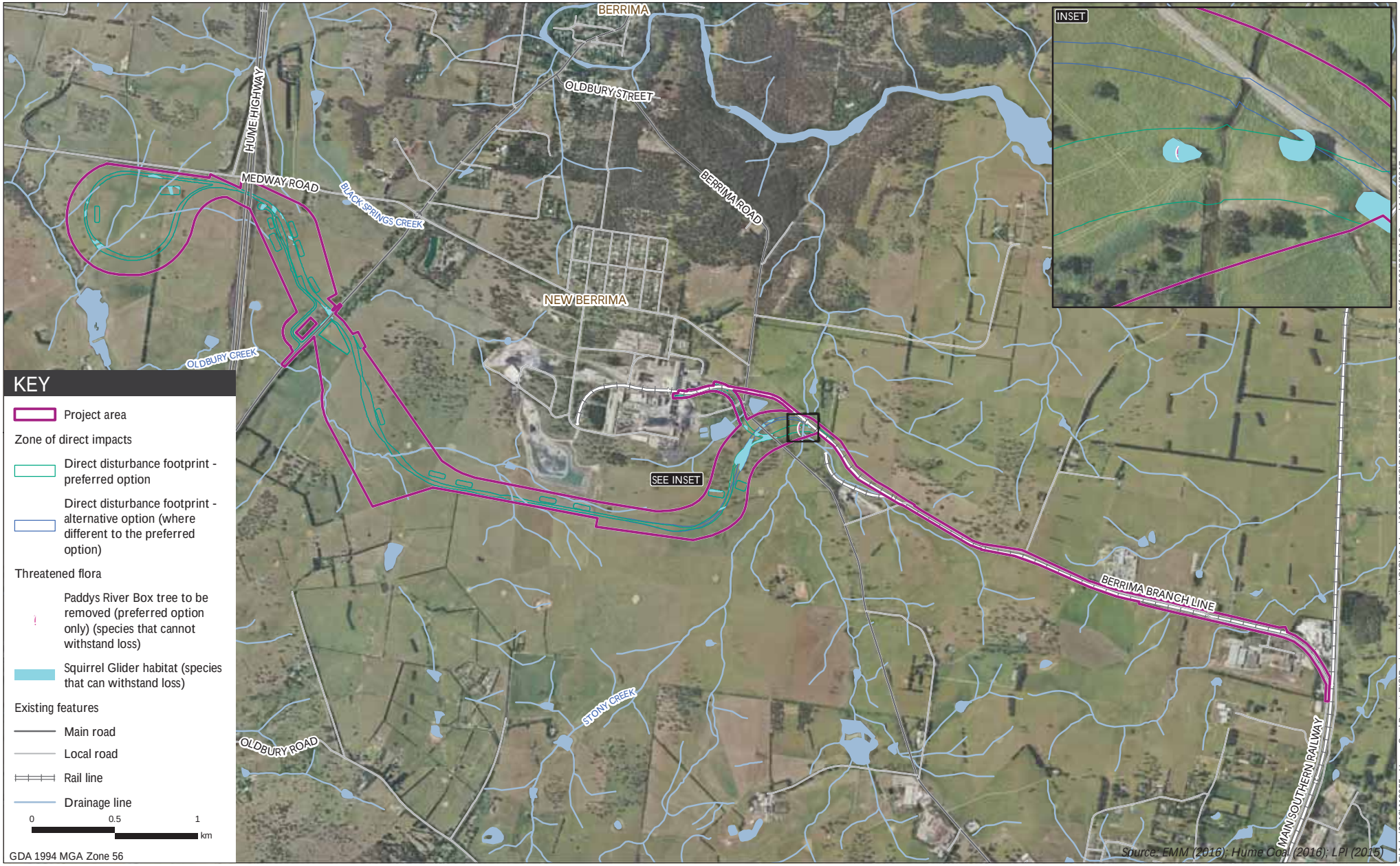


Areas that do not need to be offset

Berrima Rail Project

Biodiversity assessment report

Figure 6.2



Species credit to be offset

Berrima Rail Project

Biodiversity assessment report

Figure 6.3

Table 6.2 Species credits required

Species	Threatened species offset multiplier	Credits required to offset impact
Squirrel Glider	2.2	44
Paddys River Box (preferred option only)	1.4	14

7 Biodiversity offset strategy

7.1 Strategy

The strategy to identify offsets to compensate for the project's impacts will involve the following steps, in order of priority:

1. identifying if suitable credits are available on the BioBanking Credit Register to meet offset requirements;

1. finding potential offset sites with the biodiversity values required to compensate for the project's impacts;

2. in the absence of suitable offset credits or properties, applying the variation criteria rules of the FBA and finding suitable offsets to meet the requirements; and

3. a financial contribution.

The BioBanking Credit Register was searched on 21 November 2016 for ecosystem credits issued for PCT 1191 (HN589) and species credits for the Squirrel Glider and Paddys River Box (Option 1). No suitable ecosystem credits for PCT 1191 (HN589) were available on the register at this time. Species credits were available on the BioBanking Credit Register for the Squirrel Glider; however no credits were listed for Paddys River Box. Details of the available species credits are shown in Table 7.1.

Table 7.1 Available species credits

Species credit species	Credit register ID/name	Credits available
Squirrel Glider	204	180

From a cost perspective, it would be more practical to find a single offset site that contains the required ecosystem and species credits for the project. Therefore, Option 2 was considered.

Vegetation mapping and threatened species records were reviewed for the project area to determine if potentially suitable offset areas were present, that would satisfy the offset requirements for both the Hume Coal Project and Berrima Rail Project (see Appendix H of the Hume Coal BAR for potential offset calculations). A potential offset site was assessed in the north of the project area, along Oldbury Creek.

The potential offset site comprises 32 ha of two different vegetation types (HN570 and HN589), and two Paddys River Box trees to be retained in the project area.. Table 7.2 summarises the credits generated by the offset site, and how these compare with the credit requirements for the Hume Coal Project and Berrima Rail Project. Although targeted surveys have not been completed for the Squirrel Glider, for the purposes of this investigation, its presence was assumed. Targeted surveys for the Squirrel Glider would be completed in the potential habitat to be removed and the potential offset site should it be included in the final biodiversity offset package.

Table 7.2 Credits generated versus credits required

Factor	Ecosystem credits		Species credits			
Vegetation type	**HN570**	**HN589**	**Koala**	**Squirrel Glider**	**Southern Myotis**	**Paddys River Box**
Area required (ha) for offset	29.1	2.9	32	32	32	2 trees
Credits generated by offset site	332	40	227	227	227	14
Credits required for Hume Coal Project and Berrima Rail Project	101	2	216	227	183	14
Does the site satisfy the credit requirement?	Yes	Yes	Yes	Yes	Yes	Yes

The size of the potential offset site is governed by the need to find 227 species credits for the Squirrel Glider for both projects, conservatively assuming that the species is recorded during targeted surveys and species credits are required. All other ecosystem and species credits provide in excess of what is required, and therefore if selected, it would provide a suitable site that satisfies the offset requirements for the Hume Coal Project and Berrima Rail Project.

If a land-based offset is not available (Option 2), the variation criteria will be applied (Option 3). Under the FBA, if a land-based offset is not available, the offset rules can be varied. The variation criteria allows the BioBanking Assessor to assign the number of ecosystem credits generated to a similar PCT from within the same vegetation formation. Where possible and if needed, the variation rules will be applied to the project and suitable PCTs in the same vegetation class will be identified prior to matching by formation. The application of the variation criteria, if needed, will be completed in consultation with OEH and DP&E.

If Option 3 is not possible, a discussion would be held with OEH to determine if the proponent could pay into the BioBanking Trust Fund (Option 4). The OEH's BioBanking Trust Fund is not currently operational, and therefore the approval of OEH would be required prior to the implementation of this option.

Hume Coal will prepare a Biodiversity Offset Package in consultation with OEH and DP&E, and will submit the draft to the Secretary for approval within 12 months of development consent being granted.

8 Conclusion

The biodiversity assessment recorded two native vegetation communities and a population of the endangered Paddys River Box in the study area, as well as potential habitat for the vulnerable Squirrel Glider, endangered Australian Painted Snipe, and migratory species comprising the Great Egret, Cattle Egret, Rainbow Bee-eater and Latham's Snipe. No key fish habitat or habitat for threatened fish species were recorded.

The preferred and alternative route options have been specifically designed to minimise impacts on native vegetation and threatened species habitats. Both preferred and alternative options will result in minor residual impacts on 2.0 ha of native vegetation and potential Squirrel Glider habitat. The preferred option will also remove one Paddys River Box tree, while the alternative option would retain it.

Indirect impacts including changes to surface water flows and the potential spread of soil-borne pathogens and weeds will be managed through the preparation and implementation of the project CEMP, which will include measures to manage potential impacts to biodiversity during construction.

An offset strategy has been prepared to compensate for the residual impacts on 2 ha of native vegetation and potential Squirrel Glider habitat, and the removal of one Paddys River Box tree, should the preferred option be adopted. A Biodiversity Offset Package will be prepared in consultation with OEH and DP&E, and submitted to the Secretary for approval.

References

Aquila Ecological Surveys 2010, *New Berrima Clay/Shale Quarry Fauna Assessment.* Report prepared for Austral Bricks.

Atlas of Living Australia (ALA) 2016, The Atlas of Living Australia, viewed March 2016, www.ala.org.au.

Bibbly, C, Burgess, N and Hill, D 1992, *Bird Census Techniques,* Academic Press, London.

Bureau of Meteorology (BoM) 2016b, Atlas of Groundwater Dependent Ecosystems, viewed March 2016, www.bom.gov.au/groundwater/gde.

Corben, C 2011, *Analook for Windows*.

Department of Environment (DoE) 2013, *EPBC Act Policy Statement 1.1 Significant Impact Guidelines: Matters of National Environmental Significance*, viewed July 2016, www.environment.gov.au.

- 2016a, *Protected Matters Search Tool,* viewed March 2016, www.environment.gov.au.
- 2016b, *Conservation Advice for Paddys River Box,* viewed July 2016, www.environment.gov.au.

Department of Environment and Climate Change (DECC) 2012, *Biometric Vegetation Types Database,* viewed March 2016, www.environment.nsw.gov.au.

Department of Environment and Conservation (DEC) 2004, *Threatened Biodiversity Survey and Assessment: Guidelines for Developments and Activities*.

Department of Environment, Climate Change and Water (DECCW) 2010d, *Guidelines for developments adjoining land and water managed by the Department of Environment, Climate Change and Water*.

Department of Environment, Water, Heritage and the Arts (DEWHA) 2010a, *Survey guidelines for Australia's threatened bats*.

- 2010b, *Survey guidelines for Australia's threatened birds*.

Department of Primary Industries (DPI) 2013, Policy and guidelines for fish habitat conservation and management: Update 2013, viewed July 2016, www.dpi.nsw.gov.au.

- no date, Key Fish Habitat map for Wingecarribee Shire, viewed July 2016, www.dpi.nsw.gov.au.

Department of Sustainability, Environment, Water, Population and Communities (SEWPaC) 2011a, *Survey guidelines for Australia's threatened mammals*.

- 2011b, The Draft referral guidelines for the Macquarie Perch, viewed July 2016, www.environment.gov.au.

EcoLogical 2003, *Wingecarribee Biodiversity Strategy.* Report prepared for Wingecarribee Shire Council.

Geoff Cunningham Natural Resource Consultants (Cunningham) 2010, *New Berrima Clay/Shale Quarry Flora Assessment.* Report prepared for Austral Bricks.

Kevin Mills and Associates 2010, *Green Valley Sand Quarry Flora and Fauna Assessment.* Report prepared for Rocla Quarries.

NSW Office of Environment and Heritage (OEH) 2011, The final determination for Southern Highlands Shale Woodland in the Sydney Basin Bioregion, viewed March 2016, www.environment.nsw.gov.au.

- 2014, *Framework for Biodiversity Assessment: NSW Biodiversity Offsets Policy for Major Projects*.

- 2016a, Vegetation Information System (VIS) database, viewed March 2016, www.environment.nsw.gov.au.

- 2016b, Atlas of NSW Wildlife, viewed March 2016, www.environment.nsw.gov.au/atlasapp/.

Phillips, S and Callaghan, J 2011, 'The spot assessment technique: a tool for determining localised levels of habitat use by Koalas', *Australian Zoologist*, 35 (3), pp. 774-780.

Threatened Species Scientific Committee (TSSC) 2006, Approved Conservation Advice for White Box Yellow Box Blakely's Red Gum Derived Native Grassland, viewed March 2016, www.environment.gov.au.

- 2011, Approved Conservation Advice for Upland Basalt Eucalypt Forest of the Sydney Basin Bioregion, viewed March 2016, www.environment.gov.au.

Appendix A

Plot and transect data

A.1 Plot and transect data

Table A.1 Plot data

Family	Common name	Scientific name	Cover abundance							Presence (X)
			Plot 1	Plot 2	Plot 3	Plot 4	Plot 5	Plot 6	Plot 7	Rapid assessment 1
Asteraceae	Dandelion	*Taraxicum officinale**	2		3					
Asteraceae	Scotch Thistle	*Onopordum acanthium**	1		2	1		1		
Asteraceae	Catsear	*Hypochaeris radicata**		2	3			1	3	X
Asteraceae	Variegated Thistle	*Silybum marianum**		1	2		2	2		
Asteraceae	Hairy Hawkbit	*Leontodon taraxacoides**							2	
Caryophyllaceae	Chilean Whitlow Wort	*Paronychia brasiliana**							1	
Chenopodiaceae	Climbing Saltbush	*Einadia nutans*							1	
Cyperaceae	-	*Carex inversa*							1	
Fabaceae-Faboideae	Clover	*Trifolium spp**				3	2			
Fabaceae-Faboideae	White Clover	*Trifolium repens**				1	2	2		
Fabaceae-Faboideae	Spotted Burr Medic	*Medicago arabica**					1			
Juncaceae	-	*Juncus australis*							1	
Malaceae	Apple	*Malus spp.**								X
Myrtaceae	Narrow-leaved Peppermint	*Eucalyptus radiata*	3	2		3	4	2		
Myrtaceae	Cabbage Gum	*Eucalyptus amplifolia*		3	3		3			
Myrtaceae	Broad-leaved Peppermint	*Eucalyptus dives*		3		3		1		
Myrtaceae	Paddys River Box	*Eucalyptus macarthurii*						3		
Myrtaceae	Snow Gum	*Eucalyptus pauciflora*							2	X
Oxalidaceae	-	*Oxalis perennans*					1			
Plantaginaceae	Lamb's Tongues	*Plantago lanceolata**	3	3	3	2	2	3		
Poaceae	Cocksfoot	*Dactylis glomerata**	5	5	4	4	3	4		X
Poaceae	Kikuyu	*Pennisetum clandestinum**	3	3	4	3	4	2		X
Poaceae	Serrated Tussock	*Nassella trichotoma**	2	3			2	2	5	X
Poaceae	Finger Grass	*Dactyloctenium radulans*		2			3	4		
Poaceae	Rats Tail Grass	*Sporobolus creber*				1	1		2	
Poaceae	African Lovegrass	*Eragrostis curvula**							3	
Polygonaceae	Sheep Sorrel	*Acetosella vulgaris**			2					

Table A.2 Transect data

Transect	Native plant species	Native overstorey species (% cover)	Native midstorey species (% cover)	Native groundcover (grasses) (% cover)	Native groundcover (shrubs) (% cover)	Native groundcover (other) (% cover)	Exotic plant species (% cover)	Number of trees with hollows	Overstorey regeneration (proportion)	Fallen logs (m)
Transect 1	2	4.5	0	0	0	0	100	0	0	10
Transect 2	4	24.5	0	0	0	0	100	2	0	0
Transect 3	1	1	0	0	0	0	100	0	0	0
Transect 4	3	8	0	0	0	0	100	1	0	0
Transect 5	4	4.7	0	0	10	0	100	1	0	0
Transect 6	3	13.5	0	0	0	0	90	1	0	5
Transect 7	6	24.5	0	0	0	10	100	15	0	270

Appendix B

Assessment of threatened species likelihood of occurrence

B.1 Assessment of threatened species likelihood of occurrence

Table B.1 Threatened biodiversity recorded or with the potential to occur within 10 kilometres (km) of the study area

Threatened biodiversity	Source	TSC Act status	EPBC Act status	Record details and habitat requirements[1]	Likelihood of occurrence in the study area and surrounds	Further assessment required?
Flora						
Asterolasia elegans	SPRAT	E	E	Not known from the study area or surrounds. Occurs north of Sydney in the Baulkham Hills, Hawkesbury and Hornsby local government areas. *Asterolasia elegans* is found in sheltered forests on mid- to lower slopes and valleys, eg in or adjacent to gullies which support sheltered forest.	None. No populations recorded nearby and habitat is unsuitable.	No
Black Gum *Eucalyptus aggregata*	Atlas, BBCC	V (spp), E (pop)	V	Recorded 2 km to the west of Berrima and also multiple records at Oldbury Road near Medway Rivulet. In NSW it occurs in the South Eastern Highlands Bioregion and on the western fringe of the Sydney Basin Bioregion. Black Gum has a moderately narrow distribution, occurring mainly in the wetter, cooler and higher parts of the tablelands. Often grows with other cold-adapted eucalypts, such as Snow Gum or White Sallee (*Eucalyptus pauciflora*), Manna or Ribbon Gum (*E. viminalis*), Candlebark (*E. rubida*), Black Sallee (*E. stellulata*) and Swamp Gum (*E. ovata*). Black Gum usually occurs in an open woodland formation with a grassy groundlayer dominated either by River Tussock (*Poa labillardierei*) or Kangaroo Grass (*Themeda australis*), but with few shrubs.	None. Targeted searches failed to detect any individuals.	Assessed in Section 4.2.
Bynoe's Wattle *Acacia bynoeana*	Atlas, BBCC	E	V	Recorded 2 km north of the project in 1906. The species occurs in heath or dry sclerophyll forest on sandy soils. It prefers open, slightly disturbed roadsides, trail margins and recently burnt patches. Associated species comprise Red Bloodwood (*Corymbia gummifera*), Scribbly Gum (*E. racemosa*), Parramatta Red Gum (*Eucalyptus parramattensis*), Saw Banksia (*Banksia serrata*) and Narrow-leaved Apple (*Angophora bakeri*).	None. Suitable habitat is absent from the study area.	No
Dwarf Kerrawang *Rulingia prostrata*	BBCC	E	E	Dwarf Kerrawang occurs on the Southern Highlands and Southern Tablelands at Penrose State Forest, Tallong, near the Corang River, Rowes Lagoon, and on the North Coast at the Tomago sandbeds north of Newcastle. Associated native species may include *Imperata cylindrica, Empodisma minus* and *Leptospermum continentale*.	None. Suitable habitat is absent from the study area.	No

Table B.1 Threatened biodiversity recorded or with the potential to occur within 10 kilometres (km) of the study area

Threatened biodiversity	Source	TSC Act status	EPBC Act status	Record details and habitat requirements[1]	Likelihood of occurrence in the study area and surrounds	Further assessment required?
Paddys River Box *Eucalyptus macarthurii*	Atlas, BBCC	E	E	Several records surround the study area and also during the current study. Occurs in grassy woodland on relatively fertile soils on broad cold flats.	Recorded in study area.	No. Individuals will not be directly impacted by the project.
Thick-lipped Spider Orchid *Caladenia tessellata*	SPRAT	E	V	Not known to occur in the study area or surrounds. The Thick Lip Spider Orchid is generally found in grassy sclerophyll woodland on clay loam or sandy soils, though the population near Braidwood is in low woodland with stony soil. The single leaf regrows each year.	Low. No populations recorded nearby and habitat is unsuitable.	No
Hoary Sunray *Leucochrysum albicans* var. *tricolor*	SPRAT, Atlas	-	E	In NSW and ACT, Hoary Sunray occurs in grasslands, grassy areas in woodlands and dry open forests, and modified habitats, on a variety of soil types including clays, clay loams, stony and gravely soil.	Low. No populations recorded nearby and habitat is unsuitable.	No
Leafless Tongue Orchid *Cryptostylis hunteriana*	SPRAT	V	V	Not known from the study area or surrounds. The Leafless Tongue Orchid does not appear to have well defined habitat preferences and is known from a range of communities, including swamp-heath and woodland. The larger populations typically occur in woodland dominated by Scribbly Gum (*E. sclerophylla*), Silvertop Ash (*E. sieberi*), Red Bloodwood (*Corymbia gummifera*) and Black Sheoak (*Allocasuarina littoralis*).	None. No populations recorded nearby and habitat is unsuitable.	No
Yellow Gnat Orchid *Genoplesium baueri*	SPRAT	E	E	Not known from the study area or surrounds. The Yellow Gnat-orchid has been recorded from locations between Ulladulla and Port Stephens. Grows in dry sclerophyll forest and moss gardens over sandstone.	Low. No populations recorded nearby and habitat is unsuitable.	No
Cambage Kunzea *Kunzea cambagei*	NPWS Atlas, SPRAT	V	V	Last recorded in 1999 at Loch Catherine Colliery. It is restricted to damp, sandy soils in wet heath or mallee open scrub at higher altitudes on sandstone outcrops or Silurian group sediments. *Kunzea cambagei* mainly occurs in the western and southern parts of the Blue Mountains, NSW, namely the Yerranderie/Mt Werong area. Populations are also located west of Berrima, along the Wingecarribee River; Loombah Plateau east of Mount Werong; the Oberon-Colong Stock Route within Kanangra-Boyd National Park (NP); and Wangaderry Plateau within the Nattai National Park.	Not recorded or likely to occur in the study area as the required mallee open scrub habitat is absent.	No

Table B.1 Threatened biodiversity recorded or with the potential to occur within 10 kilometres (km) of the study area

Threatened biodiversity	Source	TSC Act status	EPBC Act status	Record details and habitat requirements[1]	Likelihood of occurrence in the study area and surrounds	Further assessment required?
Omeo's Storksbill *Pelargonium* sp. Striatellum	SPRAT	E	E	Not known from the study area or surrounds. The Omeo Stork's-bill is known from only three locations in NSW, with two on lake-beds on the basalt plains of the Monaro and one at Lake Bathurst.	None. No populations recorded nearby and habitat is unsuitable.	No
Mittagong Geebung *Persoonia glaucescens*	NPWS Atlas, SPRAT	E	V	Last recorded in 2012 off Wombeyan Caves Road in High Range. Also recorded on the outskirts of Berrima. The Mittagong Geebung is distributed from Berrima in the south to Buxton in the north. The Mittagong Geebung grows in woodland to dry sclerophyll forest on clayey and gravely laterite. The preferred topography is ridge-tops, plateaux and upper slopes.	None. Suitable habitat is absent from the study area and surrounds.	No
Dwarf Phyllota *Phyllota humifusa*	NPWS Atlas, SPRAT	V	V	Dwarf Phyllota is known from the southern Blue Mountains (Bimlow Tableland), the Joadja area west of Mittagong and Penrose area near Paddys River. The species occurs in dry sclerophyll forest, sometimes near swamps, in deep sandy soils or gravely loams over a sandstone substrate. Accompanying trees are often Brittle Gum, Narrow-leaved Peppermint or Sydney Peppermint (*E. piperita*).	None. The study area does not contain the required combination of canopy species.	No
Kangaloon Sun Orchid *Thelymitra kangaloonica*	SPRAT	CE	CE	Not known from the study area or surrounds. The Kangaloon Sun-orchid is found in swamps in sedgelands over grey silty grey loam soils, and is restricted to the area around Wingecarribee Swamp. It is thought to be a short-lived perennial, flowering in late October and early November.	None. Restricted to Wingecarribee Swamp.	No
Austral Toadflax *Thesium australe*	SPRAT	V	V	Not known from the study area or surrounds. Austral Toadflax occurs in grassland on coastal headlands, and inland grassy woodlands, often in association with Kangaroo Grass (*Themeda australis*).	Low. Not known from the study area and surrounds.	No

Table B.1 Threatened biodiversity recorded or with the potential to occur within 10 kilometres (km) of the study area

Threatened biodiversity	Source	TSC Act status	EPBC Act status	Record details and habitat requirements[1]	Likelihood of occurrence in the study area and surrounds	Further assessment required?
Birds						
Blue-billed Duck *Oxyura australis*	NPWS Atlas	V	-	Recorded north of Wingello SF in 1989. The Blue-billed Duck is endemic to south-eastern and south-western Australia. It is widespread in NSW, but most common in the southern Murray-Darling Basin area. Birds disperse during the breeding season to deep swamps up to 300 km away. The Blue-billed Duck prefers deep water in large permanent wetlands and swamps with dense aquatic vegetation. The species is completely aquatic, swimming low in the water along the edge of dense cover. Blue-billed Ducks will feed by day far from the shore, particularly if dense cover is available in the central parts of the wetland.	None. Dams and waterways are absent from the disturbance footprint.	No
Freckled Duck *Stictonetta naevosa*	NPWS Atlas	V	-	Recorded in Moss Vale in 2011. The Freckled Duck is found primarily in south-eastern and south-western Australia, and occurs as a vagrant elsewhere. Prefers permanent freshwater swamps and creeks with heavy growth of Bullrushes (*Typha spp*) Lignum (*Muelenbeckia spp*) and/or Tea-tree (*Melaleuca spp*). During drier times they move from ephemeral breeding swamps to more permanent waters such as lakes, reservoirs, farm dams and sewage ponds.	None. Dams and waterways are absent from the disturbance footprint.	No
Little Eagle *Hieraeetus morphnoides*	NPWS Atlas	V	-	Last recorded nearby in 2009 at Exeter. It is found throughout the Australian mainland, excepting the most densely forested parts of the Dividing Range escarpment. It occurs as a single population throughout NSW. Occupies open eucalypt forest, woodland or open woodland. Sheoak or *Acacia* woodlands and riparian woodlands of interior NSW are also used.	Sparse woodlands in the disturbance footprint may provide hunting habitat for the species.	**Offsets will be provided for this ecosystem species in accordance with the FBA.**
Gang-gang Cockatoo *Callocephalon fimbriatum*	NPWS Atlas	V	-	Recorded nearby in 2008 at Comfort Hill, Moss Vale. It has also been recorded around the study area in Moreton NP, Bangadilly NP, Penrose Sate Forest (SF), Joadja NR and Nattai NP. In NSW, the Gang-gang Cockatoo is distributed from the south-east coast to the Hunter region, and inland to the Central Tablelands and south-west slopes. In summer, it is generally found in tall mountain forests and woodlands, particularly in heavily timbered and mature wet sclerophyll forests. In winter, it may occur at lower altitudes in drier more open eucalypt forests and woodlands, and is often found in urban areas.	Sparse woodlands in the disturbance footprint may provide foraging habitat for the species.	**Offsets will be provided for this ecosystem species in accordance with the FBA.**

Table B.1 Threatened biodiversity recorded or with the potential to occur within 10 kilometres (km) of the study area

Threatened biodiversity	Source	TSC Act status	EPBC Act status	Record details and habitat requirements[1]	Likelihood of occurrence in the study area and surrounds	Further assessment required?
Powerful Owl *Ninox strenua*	NPWS Atlas	V	-	Several records in Moreton NP, Bangadilly NP and around the outskirts of Nattai NP. The Powerful Owl is endemic to eastern and south-eastern Australia, mainly on the coastal side of the Great Dividing Range from Mackay to south-western Victoria. In NSW, it is widely distributed throughout the eastern forests from the coast inland to tablelands, with scattered, mostly historical records on the western slopes and plains. Now uncommon throughout its range where it occurs at low densities. It roosts by day in dense vegetation comprising species such as Turpentine *Syncarpia glomulifera*, Black She-oak *Allocasuarina littoralis*, Blackwood *Acacia melanoxylon*, Rough-barked Apple *Angophora floribunda*, Cherry Ballart *Exocarpus cupressiformis* and a number of eucalypt species.	Sparse woodlands in the disturbance footprint may provide hunting habitat for the species.	**Offsets will be provided for this ecosystem species in accordance with the FBA.**
Masked Owl *Tyto novaehollandiae*	NPWS Atlas	V	-	Recorded on the Wingecarribee River, approximately 1 km north of the study area in 2016. Extends from the coast where it is most abundant to the western plains. Overall records for this species fall within approximately 90% of NSW, excluding the most arid north-western corner. Lives in dry eucalypt forests and woodlands from sea level to 1100 m. A forest owl, but often hunts along the edges of forests, including roadsides. The typical diet consists of tree-dwelling and ground mammals, especially rats.	Sparse woodlands in the disturbance footprint may provide hunting habitat for the species.	**Offsets will be provided for this ecosystem species in accordance with the FBA.**
Varied Sittella *Daphoenositta chrysoptera*	NPWS Atlas	V	-	Scattered records around Marulan, Moreton NP, Wollondilly NR and Nattai NP outskirts. The Varied Sittella is sedentary and inhabits most of mainland Australia except the treeless deserts and open grasslands. Distribution in NSW is nearly continuous from the coast to the far west. Inhabits eucalypt forests and woodlands, especially those containing rough-barked species and mature smooth-barked gums with dead branches, mallee and *Acacia* woodland. Feeds on arthropods gleaned from crevices in rough or decorticating bark, dead branches, standing dead trees and small branches and twigs in the tree canopy. The species requires a high level of structural habitat complexity to persist.	Low. The species is unlikely to occur given the high degree of vegetation fragmentation.	No

Table B.1 Threatened biodiversity recorded or with the potential to occur within 10 kilometres (km) of the study area

Threatened biodiversity	Source	TSC Act status	EPBC Act status	Record details and habitat requirements[1]	Likelihood of occurrence in the study area and surrounds	Further assessment required?
Scarlet Robin *Petroica boodang*	BBCC	V	-	The Scarlet Robin is found from south-east Queensland to south-east South Australia and also in Tasmania and south west Western Australia. In NSW, it occurs from the coast to the inland slopes. This species lives in both mature and regrowth vegetation. It occasionally occurs in mallee or wet forest communities, or in wetlands and tea-tree swamps. The Scarlet Robin habitat usually contains abundant logs and fallen timber, which are important components of its habitat.	The species has been recorded in the wider locality (Belanglo State Forest) in disturbed habitats similar to the study area.	**Offsets will be provided for this ecosystem species in accordance with the FBA.**
Flame Robin *Petroica phoenicia*	NPWS Atlas	V	-	Scattered records around Marulan and also in Morton NP. The Flame Robin is endemic to south-eastern Australia, and ranges from near the Queensland border to south-east South Australia and also in Tasmania. In NSW, it breeds in upland areas and in winter, many birds move to the inland slopes and plains. It is likely that there are two separate populations in NSW, one in the Northern Tablelands, and another ranging from the Central to Southern Tablelands. It prefers clearings or areas with open groundcovers. It often occurs in recently burnt areas, however, habitat becomes unsuitable as vegetation closes up following regeneration.	This species is frequently recorded in disturbed habitats similar to the study area.	**Offsets will be provided for this ecosystem species in accordance with the FBA.**
Regent Honeyeater *Anthochaera phrygia*	NPWS Atlas, SPRAT	CE	CE	Recorded in 2001 near the Wollondilly River NR. The Regent Honeyeater mainly inhabits temperate woodlands and open forests of the inland slopes of south-east Australia. Birds are also found in drier coastal woodlands and forests in some years. Once recorded between Adelaide and the central coast of Queensland, its range has contracted dramatically in the last 30 years to between north-eastern Victoria and south-eastern Queensland. Every few years non-breeding flocks are seen foraging in flowering coastal Swamp Mahogany and Spotted Gum forests, particularly on the central coast and occasionally on the upper north coast. Birds are occasionally seen on the south coast.	Low. The study area does not contain important winter flowering eucalypts.	No
Swift Parrot *Lathamus discolor*	SPRAT	E	E	Not known from the study area or surrounds. The Swift Parrot migrates to the Australian south-east mainland between March and October. On the mainland they occur in areas where eucalypts are flowering profusely or where there are abundant lerp (from sap-sucking bugs) infestations. They return to Tasmania to breed between September to December.	Low. Targeted surveys completed for winter flowering eucalypts and Swift Parrots, and neither were detected.	No

Table B.1 Threatened biodiversity recorded or with the potential to occur within 10 kilometres (km) of the study area

Threatened biodiversity	Source	TSC Act status	EPBC Act status	Record details and habitat requirements[1]	Likelihood of occurrence in the study area and surrounds	Further assessment required?
Australasian Bittern *Botaurus poiciloptilus*	NPWS Atlas, SPRAT	E	E	Recorded close to the study area in 1999 in Cecil Hoskins Nature Reserve near Moss Vale. Australasian Bitterns are widespread but uncommon over south-eastern Australia. In NSW they may be found over most of the state except for the far north-west. They favour permanent freshwater wetlands with tall, dense vegetation, particularly bullrushes (*Typha* spp.) and spikerushes (*Eleocharis* spp.). They hide during the day amongst dense reeds or rushes and feed mainly at night on frogs, fish, yabbies, spiders, insects and snails.	None. The study area does not contain permanent freshwater wetlands with fringing vegetation.	No
Painted Honeyeater *Grantiella picta*	SPRAT	V	V	Inhabits Boree, Brigalow and Box-Gum Woodlands and Box-Ironbark Forests. A specialist feeder on the fruits of mistletoes growing on woodland eucalypts and acacias. Prefers mistletoes of the genus *Amyema.*	None. The study area does not contain the required vegetation types.	No
Great Egret *Ardea alba*	SPRAT	-	Mi	Not recorded in the study area or nearby surrounds. They occur in swamps and marshes; margins of rivers and lakes; damp or flooded grasslands, pastures or agricultural lands; reservoirs; sewage treatment ponds; and drainage channels. The frequent shallow water when foraging.	**Moderate likelihood of occurrence in low-lying area east of Berrima Road when grassland is inundated.**	**Yes**
Cattle Egret *Ardea ibis*	SPRAT	-	Mi	Not recorded in the study area or nearby surrounds. Two major distributions have been located; from north-east Western Australia to the Top End of the Northern Territory and around south-east Australia. It occurs in tropical and temperate grasslands, wooded lands and terrestrial wetlands. High numbers have been observed in moist, low-lying poorly drained pastures with an abundance of high grass; it avoids low grass pastures.	**Moderate likelihood of occurrence in low-lying area east of Berrima Road when grassland is inundated.**	**Yes**
Rainbow Bee-eater *Merops ornatus*	SPRAT	-	Mi	Not recorded in the study area or nearby surrounds. The Rainbow Bee-eater is distributed across much of mainland Australia, and occurs on several near-shore islands. It is not found in Tasmania, and is thinly distributed in the most arid regions of central and Western Australia. It usually occurs in open, cleared or lightly-timbered areas that are often, but not always, located in close proximity to permanent water. The Rainbow Bee-eater is also common in cleared and semi-cleared habitats ie farmland.	**Moderate potential to the study area given its agricultural setting.**	**Yes**
Satin Flycatcher *Myiagra cyanoleuca*	SPRAT	-	Mi	Not recorded in the study area or nearby surrounds. The Satin Flycatcher is widespread in eastern Australia and vagrant to New Zealand (Blakers et al. 1984; Coates 1990). Satin Flycatchers inhabit heavily vegetated gullies in eucalypt-dominated forests and taller woodlands, and on migration, occur in coastal forests, woodlands, mangroves and drier woodlands and open forests.	None. Heavily vegetated gullies are absent from the study area.	No

Table B.1 Threatened biodiversity recorded or with the potential to occur within 10 kilometres (km) of the study area

Threatened biodiversity	Source	TSC Act status	EPBC Act status	Record details and habitat requirements[1]	Likelihood of occurrence in the study area and surrounds	Further assessment required?
Rufous Fantail *Rhipidura rufifrons*	SPRAT	-	Mi	Not recorded in the study area or nearby surrounds. The Rufous Fantail occurs in coastal and near coastal districts of northern and eastern Australia (Lindsey 1992). In east and south-east Australia, the Rufous Fantail mainly inhabits wet sclerophyll forests, often in gullies dominated by eucalypts such as Tallow-wood (*E. microcorys*), Mountain Grey Gum (*E. cypellocarpa*), Narrow-leaved Peppermint, Mountain Ash (*E. regnans*), Alpine Ash (*E. delegatensis*), Blackbutt (*E. pilularis*) or Red Mahogany (*E. resinifera*); usually with a dense shrubby understorey often including ferns.	None. Wet sclerophyll forests are absent from the study area.	No
Australian Painted Snipe *Rostratula australis*	SPRAT, NPWS Atlas	E	E	Recorded from a farm dam in Berrima in 2010. The Australian Painted Snipe prefers fringes of swamps, dams and nearby marshy areas where there is a cover of grasses, lignum, low scrub or open timber. The Australian Painted Snipe nests on the ground amongst tall vegetation, such as grasses, tussocks or reeds. Feeding platforms may be constructed over deeper water from reeds trampled by the bird; platforms are often littered with prey remains.	**May occur in farm dams adjacent to the study area.**	**Yes**
White-throated Needletail *Hirundapus caudacutus*	SPRAT	-	Mi	Recorded in Exeter (10 km south-west of the project) in 2010. The White-throated Needletail occurs in open forest, rainforest, heathland, grassland and swamps. The species breeds in wooded lowlands and sparsely vegetated hills, as well as mountains covered with coniferous forests. This species is almost exclusively aerial, rarely coming to the ground.	Low. This species is almost exclusively aerial.	No
Black-faced Monarch *Monarcha melanopsis*	SPRAT	-	Mi	Last recorded in Bowral in 1995, approximately 10 km north-east of the project. The Black-faced Monarch occurs mainly in rainforest ecosystems but sometimes is found in nearby open eucalypt forests in gullies with a dense, shrubby, or patchy understorey.	Low. Rainforest is absent from the study area and surrounds.	No
Latham's Snipe *Gallinago hardwickii*	SPRAT	-	Mi	Not known from within 10 km of the study area. In Australia, Latham's Snipe occurs in permanent and ephemeral wetlands up to 2000 m above sea-level. They usually inhabit open, freshwater wetlands with low, dense vegetation (e.g. swamps, flooded grasslands or heathlands, around bogs and other water bodies).	**Moderate likelihood of occurrence in low-lying area east of Berrima Road when grassland is inundated.**	**Yes**
Osprey *Pandion haliaeetus*	SPRAT	V	Mi	Favour coastal areas, especially the mouths of large rivers, lagoons and lakes. Feed on fish over clear, open water.	None. Large waterbodies are absent from the study area.	No

Table B.1 Threatened biodiversity recorded or with the potential to occur within 10 kilometres (km) of the study area

Threatened biodiversity	Source	TSC Act status	EPBC Act status	Record details and habitat requirements[1]	Likelihood of occurrence in the study area and surrounds	Further assessment required?
Frogs						
Giant Burrowing Frog *Heleioporus australasicus*	SPRAT	V	V	Not known from the study area or nearby surrounds. The Giant Burrowing Frog is distributed in south eastern NSW and Victoria, and appears to exist as two distinct populations: a northern population largely confined to the sandstone geology of the Sydney Basin and extending as far south as Ulladulla, and a southern population occurring from north of Narooma through to Walhalla, Victoria. Found in heath, woodland and open dry sclerophyll forest on a variety of soil types except those that are clay based. Spends more than 95% of its time in non-breeding habitat in areas up to 300 m from breeding sites. Whilst in non-breeding habitat it burrows below the soil surface or in the leaf litter.	None. Soils in the study area are predominantly clay based, precluding the occurrence of this species.	No
Stuttering Frog *Mixophyes balbus*	SPRAT	V	V	Not recorded in the study area or nearby surrounds. The Stuttering Frog is restricted to the eastern slopes of the Great Divide, from the Cann River catchment in far East Gippsland, Victoria, to tributaries of the Timbarra River near Drake, New South Wales. They are found in association with permanent streams through temperate and sub-tropical rainforest and wet sclerophyll forest, rarely in dry open tableland riparian vegetation.	None. The required habitat types are absent from the study area.	No
Littlejohns Tree Frog *Litoria littlejohni*	SPRAT	V	V	One record directly south of Paddys River Swamps. Littlejohn's Tree Frog has a distribution that includes the plateaus and eastern slopes of the Great Dividing Range from Watagan State Forest (90 km north of Sydney) south to Buchan in Victoria. Non-breeding habitat is heath based forests and woodlands where it shelters under leaf litter and low vegetation, and hunts for invertebrate prey either in shrubs or on the ground.	None. Heath-based forests and woodlands are absent from the study area.	No
Mammals						
Koala *Phascolarctos cinereus*	NPWS Atlas, SPRAT	V	V	Recorded in Belanglo State Forest and along Oldbury Creek (EMM unpublished data). The Koala has a fragmented distribution throughout eastern Australia from north-east Queensland to the Eyre Peninsula in South Australia. In NSW it mainly occurs on the central and north coasts with some populations in the west of the Great Dividing Range. Inhabits eucalypt woodlands and forests. Feeds on the foliage of more than 70 eucalypt species and 30 non-eucalypt species, but in any one area will select preferred browse species.	Low. Although Koalas have been recorded in Belanglo State Forest (4 km west to the west), this is fragmented from the study area by the Hume Highway and Old Hume Highway. The area only contains a small proportion of feed tree species (Cabbage Gum), and is dominated by Peppermints that are not regional feed trees.	No

Table B.1 Threatened biodiversity recorded or with the potential to occur within 10 kilometres (km) of the study area

Threatened biodiversity	Source	TSC Act status	EPBC Act status	Record details and habitat requirements[1]	Likelihood of occurrence in the study area and surrounds	Further assessment required?
Grey-headed Flying-fox *Pteropus poliocephalus*	NPWS Atlas, SPRAT	V	V	Recorded in 1998 in Bundanoon. Grey-headed Flying-foxes are generally found within 200 km of the eastern coast of Australia, from Bundaberg in Queensland to Melbourne in Victoria. In times of natural resource shortages, they may be found in unusual locations. Occur in subtropical and temperate rainforests, tall sclerophyll forests and woodlands, heaths and swamps as well as urban gardens and cultivated fruit crops. Roosting camps are generally located within 20 km of a regular food source and are commonly found in gullies, close to water, in vegetation with a dense canopy.	None. No camps or individuals are known from the study area and surrounds.	No
Large-eared Pied Bat *Chalinolobus dwyeri*	NPWS Atlas, SPRAT	V	V	Recorded in 2006 at Bundanoon. Scattered recording throughout Nattai NP, Wanganderry Tablelands and Joadja NR. The Large-eared Pied Bat roosts near cave entrances, cliff crevices, old mine workings and disused Fairy Martin mud nests. They occur in low to mid- elevation dry open forest and woodland close to these shelter habitats. Females have been recorded raising young in maternity roosts from November to February in roof domes in sandstone caves and overhangs, and show high site fidelity.	None. Sandstone outcrops are absent from the study area.	No
Eastern Bentwing Bat *Miniopterus schreibersii oceanensis*	NPWS Atlas	V	-	Recorded from Belanglo State Forest, approximately 4km west of the project.. Eastern Bentwing Bats occur along the east and north-west coasts of Australia. Caves are the primary roosting habitat, but they also use derelict mines, storm-water tunnels, buildings and other man-made structures. Form discrete populations centred on a maternity cave that is used annually in spring and summer for the birth and rearing of young.	Low. Roosting caves are absent from the study area. Further, the species is unlikely to forage in the area given the high degree of vegetation fragmentation.	No
Southern Myotis *Myotis adversus*	NPWS Atlas	V	-	Recorded from Belanglo State Forest, approximately 4km west of the project. Southern Myotis is found in the coastal band from the north-west of Australia, across the top-end and south to western Victoria. It is rarely found more than 100 km inland, except along major rivers. Generally roosts in groups of 10 to 15 close to water in caves, mine shafts, hollow-bearing trees, storm water channels, buildings, under bridges and in dense foliage. Forages over streams and pools, catching insects and small fish by raking their feet across the water surface.	None. Suitable habitat (vegetated dams and waterways) are absent from the disturbance footprint.	No

Table B.1 Threatened biodiversity recorded or with the potential to occur within 10 kilometres (km) of the study area

Threatened biodiversity	Source	TSC Act status	EPBC Act status	Record details and habitat requirements[1]	Likelihood of occurrence in the study area and surrounds	Further assessment required?
Spotted-tailed Quoll *Dasyurus maculatus*	NPWS Atlas, SPRAT	V	E	Recorded in 2006 at Tallong. Also scattered records in Bundanoon, Bangadilly NP and Wangenderry Tableland. It is now found on the east coast of NSW, Tasmania, eastern Victoria and north-eastern Queensland. Only in Tasmania is it still considered common. Recorded across a range of habitat types, including rainforest, open forest, woodland, coastal heath and inland riparian forest, from the sub-alpine zone to the coastline. Individual animals use hollow-bearing trees, fallen logs, small caves, rock crevices, boulder fields and rocky-cliff faces as den sites.	Low. Closest record is located over 25 km away. Habitat is highly disturbed and would not provide sufficient cover for the species.	No
Southern Brown Bandicoot *Isoodon obselus obselus*	SPRAT	E	E	Not known from the study area or surrounds. Southern Brown Bandicoots are largely crepuscular (active mainly after dusk and/or before dawn). They are generally only found in heath or open forest with a heathy understorey on sandy or friable soils. They feed on a variety of ground-dwelling invertebrates and the fruit-bodies of hypogeous (underground-fruiting) fungi. Their searches for food often create distinctive conical holes in the soil.	None. Not known from the study area and surrounds, and suitable habitat is absent.	No
Brush-tailed Rock Wallaby *Petrogale penicillata*	NPWS Atlas, SPRAT	E	V	Several records since 2002 in Nattai NP, west of Wollondilly River and Basket Creek intersection. In NSW they occur from the Queensland border in the north to the Shoalhaven in the south, with the population in the Warrumbungle Ranges being the western limit. Occupy rocky escarpments, outcrops and cliffs with a preference for complex structures with fissures, caves and ledges, often facing north. Browse on vegetation in and adjacent to rocky areas eating grasses and forbs as well as the foliage and fruits of shrubs and trees.	None. Not known from the study area and surrounds, and suitable habitat is absent.	No
Long-nosed Potoroo *Potorous tridactylus tridactylus*	SPRAT	V	V	Not known from the study area or surrounds. The Long-nosed Potoroo inhabits coastal heaths and dry and wet sclerophyll forests. A dense understorey with occasional open areas is an essential part of this species' habitat, and may consist of grass-trees, sedges, ferns or heath, or of low shrubs of tea-trees or melaleucas.	None. Not known from the study area and surrounds, and suitable habitat is absent.	No
New Holland Mouse *Pseudomys novaehollandiae*	SPRAT	-	E	The New Holland Mouse is known from coastal areas and inland on sandstone country. It occurs in open heathland, open woodland with a heathy understorey and vegetated sand dunes.	None. The required vegetation types are absent.	No

Table B.1 Threatened biodiversity recorded or with the potential to occur within 10 kilometres (km) of the study area

Threatened biodiversity	Source	TSC Act status	EPBC Act status	Record details and habitat requirements[1]	Likelihood of occurrence in the study area and surrounds	Further assessment required?
Reptiles						
Broad-headed Snake *Hoplocephalus bungaroides*	SPRAT	E	V	Not known from study area or surrounds. The Broad-headed Snake is largely confined to Triassic and Permian sandstones, including the Hawkesbury, Narrabeen and Shoalhaven groups, within the coast and ranges in an area within approximately 250 km of Sydney. Shelters in rock crevices and under flat sandstone rocks on exposed cliff edges during autumn, winter and spring. Moves from the sandstone rocks to shelters in hollows in large trees within 200 m of escarpments in summer.	None. Sandstone escarpments are absent from the study area.	No
Fish						
Macquarie Perch *Macquaria australasica*	SPRAT	E	E	The Macquarie Perch occurs in the upper reaches of the Lachlan and Murrumbidgee Rivers in southern NSW, Mongarlowe River, the Cataract Dam and Georges River. Its preferred habitat comprises streams with deep rocky pools, clear water interspersed with riffles, slow to fast flowing water bodies, and ample cover from rocks, overhanging banks, logs, branches, emergent and submerged aquatic plants, trailing bank vegetation, stumps and clay banks.	None. The closest record is from Cataract Dam which is not connected to streams in the study area. Streams in the study area do not contain suitable habitat for the species.	No

Source: 1. Department of the Environment 2015, Species Profile and Threat Database, www.environment.gov.au, viewed September 2015, Office of Environment and Heritage 2015, Threatened Species Profile Search, www.environment.nsw.gov.au, viewed September 2015.

Appendix C

Assessments of significance

C.1 Significant impact criteria in accordance with the EPBC Act

The following sections provide the criteria that must be considered in the assessment of potential impacts to species listed under the EPBC Act. There are separate criteria for each listing category under the EPBC Act, in accordance with '*EPBC Act Policy Statement 1.1 Significant Impact Guidelines: Matters of National Environmental Significance*' (DoE 2013).

C.1.1 Significant impact criteria for critically endangered and endangered species

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

- lead to a long-term decrease in the size of a population;
- reduce the area of occupancy of the species;
- fragment an existing population into two or more populations;
- adversely affect habitat critical to the survival of a species;
- disrupt the breeding cycle of a population;
- modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline;
- result in invasive species that are harmful to a critically endangered or endangered species becoming established in the endangered or critically endangered species' habitat;
- introduce disease that may cause the species to decline; or
- interfere with the recovery of the species.

C.1.2 Significant impact criteria for listed migratory species

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

- substantially modify (including by fragmenting, altering fire regimes, altering nutrient cycles or altering hydrological cycles), destroy or isolate an area of important habitat for a migratory species;
- result in an invasive species that is harmful to the migratory species becoming established in an area of important habitat for the migratory species; or
- seriously disrupt the lifecycle (breeding, feeding, migration or resting behaviour) of an ecologically significant proportion of the population of a migratory species.

C.1.3 Assessments of significance

Assessments of significance of the project's potential impacts have been made for each of the threatened ecological communities and species listed under the EPBC Act known or with potential to occur in the study area and surrounds (Table B.1). The assessments have been made with reference to the criteria given in Sections C.1.1 to C.1.2 and the outcomes are provided in the following sections.

i Paddys River Box

Paddys River Box is listed as an endangered species under the EPBC Act. It occurs in the Southern Highlands and the Blue Mountains. In the Southern Highlands, it occurs mainly on agricultural land and roadsides. It has been estimated that Paddys River Box trees on some agricultural properties are greater than 200 years old.

Sixteen Paddys River Box trees occur in the study area. An assessment of significance has been completed in accordance with the species conservation advice (DoE 2016b) to assess potential impacts of the preferred and alternate options on Paddys River Box (Table C.1).

Table C.1 Assessment of significance for Paddys River Box

Criteria	Discussion
1: long-term decrease in population size	The Paddys River Box population in the Southern Highlands has been estimated at greater than 10,000 individual mature trees. Given their endangered conservation status, the preferred and alternate options have been designed such that impacts to Paddys River Box are avoided or minimised. The preferred option will require the removal of one Paddys River Box, while the alternate option will not have any direct impacts. If the preferred option is adopted, the removal of an individual tree will not lead to a long-term decrease in the species population size. Paddys River Box occurs on low hills, along streams and in minor drainage lines in the study area, indicating that surface water flow fulfils part of the species water requirements. Existing surface flows will be maintained at all streams where Paddys River Box occurs in the study area. While most surface flows will be re-directed around the rail loop, a culvert will be installed in the rail loop to ensure that surface flow to the seven individuals inside the rail loop is maintained. As the design largely avoids direct impacts to the species, and indirect impacts will be managed, the project will not lead to a long-term decrease in Paddys River Box population size.
2: reduce area of occupancy	The area of occupancy for Paddys River Box has been estimated at 144 km^2. As the design largely avoids direct impacts to the species and indirect impacts will be managed, the project will not reduce Paddys River Box area of occupancy.
3: fragment a population	Paddys River Box trees occur in three distinct clusters in the study area and one south of the study area, comprising the rail loop (1), west of the Old Hume Highway (2), north-east of Berrima Road (3) and south-west of Berrima Road (4), shown on Figure 3.5. Areas 1 and 2 are separated by the Hume Highway, while Areas 3 and 4 are separated by Berrima Road. Further fragmentation will not occur in Areas 1 and 2 from the preferred or alternate options. Further fragmentation of Areas 3 and 4 will not occur as the individual west of the rail line, and within the direct disturbance footprint will be removed for the preferred option. The individual west of the rail line will be retained if the alternate option is adopted. However, as it is already located approximately 250 m away from the nearest individuals, construction of the rail line is considered unlikely to lead to fragmentation of the population. The species is pollinated by mobile birds and insects, and seeds can be dispersed by wind (DoE 2016b).

Table C.1 Assessment of significance for Paddys River Box

Criteria	Discussion
4: adversely affect critical habitat	Critical habitat has not been declared for Paddys River Box on the Register of Critical Habitat under the EPBC Act. Habitat critical to the survival of endangered species is defined by the *Matters of National Environmental Significance Significant Impact Guidelines1.1* (DoE 2015) as areas that are necessary: • for activities such as foraging, breeding, roosting or dispersal; • for the long-term maintenance of the species or ecological community (including the maintenance of species essential to the survival of the species or ecological community, such as pollinators); • to maintain genetic diversity and long-term evolutionary development; or • for the re-introduction of populations or recovery of the species or ecological community. Such habitat may be, but is not limited to, habitat identified in a recovery plan for the species or ecological community as habitat critical for that species or ecological community; and/or habitat listed on the Register of Critical Habitat maintained by the minister under the EPBC Act. The large cluster of 24 individuals south of the project area, and west of Berrima Road (Figure 3.5) are considered to represent habitat critical to the survival of the species. These individuals appeared to be older than those in the project area, and occurred as a single larger aggregation of individuals. These individuals will not be directly impacted by the project as they are outside the project area.
5: disrupt the breeding cycle of a population	Paddys River Box flowers from January to February, and pollen is collected and birds and insects. Seeds are dispersed by wind and gravity (DoE 2016b). As direct impacts will be largely avoided by the project, mature Paddys River Box trees will be retained that would produce seed.
6: modify, destroy, remove, isolate or decrease availability or quality of habitat	The preferred option will require the removal of one Paddys River Box, while the alternate option will not remove any individuals. If the preferred option is adopted, the removal of an individual tree does not represent a significant reduction of individuals within and south of the study area (1 of 40 individuals in the locality), and its habitat (ie the grassland) will be retained. Surface flows will be maintained at all streams where Paddys River Box occurs in the study area. The project will not result in fragmentation of Paddys River Box trees. This is discussed further in the response to Question 3.
7: result in invasive species	Paddys River Box in the study area occur in an agricultural setting that has an exotic-dominated understorey. Therefore, the disturbance of soil for construction is unlikely to introduce additional exotic species to the area.
8: introduce disease	Introduced individuals of Paddys River Box to Africa are susceptible to infection by a fungus, *Phytophthora nicotianae.* This fungus occurs in Australia, although has not been observed to impact Paddys River Box, and is not known to occur in the Southern Highlands (ALA 2016).
9: interfere with recovery	Recovery actions for Paddys River Box are outlined in the species conservation advice (DoE 2016b). Primary conservation actions relate to the prevention of habitat destruction, maintenance and enhancement of existing and potential habitats, prevention of grazing and weed management. As direct impacts will be largely avoided for the preferred option and completely avoided for the alternate option, and indirect impacts will be managed, the project does not interfere with the species recovery.
Conclusion	The project is unlikely to result in significant impacts on Paddys River Box as: • direct impacts will be largely avoided for the preferred option; • direct impacts will be completely avoided for the alternate option; and • indirect impacts will be managed in accordance with the CEMP.

ii Australian Painted Snipe

The Australian Painted Snipe is listed as an endangered species under the EPBC Act. It was not recorded during seasonal surveys of the area. Its preferred habitat is the fringes of swamps, dams and nearby marshy areas with a cover of grasses, lignum, low scrub or open timber. There is a moderate potential that this species may occasionally forage in the region, as this species was recorded foraging at a farm dam in nearby Berrima in 2010. An assessment of significance has been completed to assess potential impacts from the preferred and alternate options on this endangered species (Table C.2).

Table C.2 Assessment of significance for the Australian Painted Snipe

Criteria	Discussion
1: long-term decrease in population size	Given the location of the dam outside the study area and the preferred and alternate options, potential habitat will not be cleared and direct impacts will not occur. The project will result in an increase of train movements, which will likely result in minor increases to indirect impacts such as noise and light. As there is an existing rail line in the area, these minor increases to indirect impacts are unlikely to adversely affect a population of Australian Painted Snipes, if present in the area. Australian Painted Snipe breeding habitat is absent from this area, and therefore it would not disrupt any breeding activities. Therefore, the project is unlikely to result in a long-term decrease in population sizes of these endangered species.
2: reduce area of occupancy	Given there is no habitat inside the study area, direct impacts will not occur. Therefore, the project is unlikely to reduce the area of occupancy of these endangered species.
3: fragment a population	Given there is no habitat inside the study area, direct impacts will not occur. Therefore, populations of these endangered species will not be fragmented by the project.
4: adversely affect critical habitat	Critical habitat has not been declared for the Australian Painted Snipe. Habitat critical to the survival of a species is defined in DoE (2013) as areas necessary for the long-term maintenance of the species. Areas that would represent critical habitat for the Australian Painted Snipe would include areas of tall vegetation including reeds where they could construct a nest. As the area is currently in use for cattle grazing, suitable groundcover to construct a nest is absent. Therefore, the project will not adversely affect habitat critical to the Australian Painted Snipe.
5: disrupt the breeding cycle of a population	As breeding habitat is absent from within and adjacent to the study area, the breeding cycle of the Australian Painted Snipe population (if present) is unlikely to be disrupted.
6: modify, destroy, remove, isolate or decrease availability or quality of habitat	Given there is no habitat inside the study area, the availability and quality of habitat for the Australian Painted Snipe will not be modified, destroyed or isolated.
7: result in invasive species	The study area is located in an agricultural setting, and therefore already contains the Feral Rabbit (*Oryctolagus cuniculus*) and European Red Fox (*Vulpes vulpes*). Actions that can result in these invasive species spreading into new areas to the detriment of native species include the creation of new linear infrastructure through large areas of native bushland. As the project is located in an agricultural setting where native vegetation and habitat have been heavily modified, the project is not expected to result in the introduction or spread of invasive animal or plant species.
8: introduce disease	The Australian Painted Snipe is not known to be subject to any disease. Therefore, the project is not expected to result in the introduction or spread of disease that would adversely affect the Australian Painted Snipe.

Table C.2 Assessment of significance for the Australian Painted Snipe

Criteria	Discussion
9: interfere with recovery	A recovery plan has not been prepared for the Australian Painted Snipe. As no direct impacts will occur to their habitat and only a minor increase to indirect impacts will occur, the project is unlikely to interfere with the recovery of their habitat or population (if present).
Conclusion	The project is unlikely to result in significant impacts to the Australian Painted Snipe as: • direct impacts will not occur as its potential habitat is outside the study area; and • only a minor increase in indirect impacts is expected as the area contains an existing rail line.

iii Migratory birds with potential to occur in the study area: Rainbow Bee-eater, Great Egret, Cattle Egret and Latham's Snipe

The Rainbow Bee-eater, Great Egret, Cattle Egret and Latham's Snipe are listed as migratory terrestrial species under the EPBC Act. None of these species were recorded in the study area during seasonal surveys. However, there is a moderate likelihood that the Rainbow Bee-eater would occur as they are regularly recorded from agricultural areas, and the Great Egret, Cattle Egret and Latham's Snipe may occasionally forage in the low-lying area east of Berrima Road.

An assessment of significance has been completed to assess potential impacts of the preferred and alternate options on these migratory birds (Table C.3).

Table C.3 Assessment of significance for migratory birds: Rainbow Bee-eater, Great Egret, Cattle Egret and Latham's Snipe

Assessment part	Discussion
1: substantially modify important habitat	The study area (including the preferred and alternate options) does not constitute an area of important habitat for these species, as an ecologically significant proportion (as defined under the guidelines (DoE 2013)) of their populations do not reside in the study area, breeding occurs outside the study area (Northern Territory, coastal areas and inland wetlands), it is not at the limit of their range and they are not known to be declining.
2: result in invasive species	These migratory species are known to be subject to predation by the European Red Fox. The European Red Fox has been recorded in the wider study area. The project does not involve any activities such as creation of new access roads through native vegetation, which could result in the introduction or spread of invasive species such as the European Red Fox.
3: disrupt lifecycle of ecologically significant proportion of population	An ecologically significant proportion of the Rainbow Bee-eater, Great Egret, Cattle Egret and Latham's Snipe populations do not reside in the study area. In addition, breeding activity occurs outside the study area and the project is unlikely to disrupt their migration patterns as they are highly mobile species. Therefore the project will not disrupt the lifecycle of an ecologically significant proportion of the Rainbow Bee-eater, Great Egret, Cattle Egret and Latham's Snipe populations (if present).
Conclusion	The project is unlikely to result in significant impacts to the Rainbow Bee-eater, Great Egret, Cattle Egret or Latham's Snipe as: • important habitat is absent from the study area, and therefore will not be substantially modified; • the project will not increase the spread of invasive species; and • the lifecycle of an ecologically significant proportion of the migratory species populations will not be disrupted, as breeding occurs outside the study area.

C.2 References

Atlas of Living Australia (ALA) 2016, *Phytophthora nicotiniae,* biocache.ala.org.au, viewed 16 August 2016.

Department of Environment (DoE) 2013, *EPBC Act Policy Statement 1.1 Significant Impact Guidelines: Matters of National Environmental Significance*, www.environment.gov.au, viewed July 2016.

Department of Environment (DoE) 2016, *Conservation Advice for Paddys River Box,* www.environment.gov.au, viewed July 2016.

Appendix D

Compliance of the assessment against FBA requirements

D.1 Compliance of the assessment against the FBA mapping requirements

This section demonstrates the compliance of the assessment against the FBA mapping requirements. The assessment is provided in Table D.1 to Table D.3.

Table D.1 Assessment of compliance with FBA requirements for the site map

FBA reference	Requirement	Comply?	BAR reference
3.2.1.2	Digital aerial photography	Yes	Figure 3.1, Figure 3.2 and Appendix E
3.2.1.2(a)	1:1000 or finer	Yes	Figures in Appendix E
3.2.1.2(a)(i)	Boundary of development site	Yes	Figure 3.1, Figure 3.2 and Appendix E
3.2.1.2(a)(ii)	Cadastre	Yes	Figure 3.1, Figure 3.2 and Appendix E
4.1.1.2	IBRA bioregion and IBRA subregions	Yes	Figure 3.1, Figure 3.2 and Appendix E
4.1.1.2	Mitchell landscapes	Yes	Figure 3.1, Figure 3.2 and Appendix E
4.1.1.2	Rivers and streams	Yes	Figure 3.1, Figure 3.2 and Appendix E
4.1.1.2	Wetlands	N/A. There are no important wetlands in the project area or buffer area.	N/A
4.1.1.2	Extent of native vegetation in the outer assessment circle or the buffer area surrounding the development footprint	Yes	Figure 3.1, Figure 3.2 and Appendix E
4.1.1.2	Any other landscape features that are required by the SEARs for assessment at a development site.	N/A. No other landscape features are required by the SEARs.	N/A
4.1.1.3	All IBRA bioregions and IBRA subregions within the development site must be identified and shown on the Site Map.	Yes	Figure 3.1, Figure 3.2 and Appendix E
4.1.1.5	All Mitchell landscapes within the development site must be identified and shown on the Site Map.	Yes	Figure 3.1, Figure 3.2 and Appendix E
4.1.1.8	All rivers, streams and estuaries that occur within the development site, and their riparian buffer areas, must be identified and shown on the Site Map.	Yes	Figure 3.1, Figure 3.2 and Appendix E
4.1.1.11	All important and local wetlands that occur within the development site must be identified and shown on the Site Map.	Yes	Figure 3.1, Figure 3.2 and Appendix E
4.1.1.13	Important wetlands must also be separately identified and shown on the Site Map and the Location Map.	N/A. There are no important wetlands in the project area or buffer area.	N/A
4.1.1.16	All state or regionally significant biodiversity links that occur within the development site must be identified and shown on the Site Map.	Yes	Figure 3.1, Figure 3.2 and Appendix E
4.1.1.18	Other landscape features should be mapped on both the Site Map and Location Map if this is a requirement of the SEARs.	Yes	Figure 3.1, Figure 3.2 and Appendix E

Table D.1 Assessment of compliance with FBA requirements for the site map

FBA reference	Requirement	Comply?	BAR reference
5.1.1.2	The native vegetation extent on the development site must be shown on the Site Map, which must include all land in the development site.	Yes	Figure 3.1, Figure 3.2 and Appendix E

Table D.2 Assessment of compliance with FBA requirements for the location map

FBA reference	Requirement	Comply?	BAR reference
3.2.1.2	Digital aerial photography	Yes	Figure 3.1, Figure 3.2 and Appendix E
3.2.1.2(b)	1:10,000 or finer	Yes	Figures in Appendix E
3.2.1.2(b)(i)	All landscape features in Chapter 4	Yes	Figure 3.1, Figure 3.2 and Appendix E
3.2.1.2(b)(ii)	Boundary of development site	Yes	Figure 3.1, Figure 3.2 and Appendix E
3.2.1.2(b)(iii)	Local area boundaries or other base data relevant at this scale	Yes	Figure 3.1, Figure 3.2 and Appendix E
3.2.1.3	Area covered by the outer assessment circle according to Appendix 4, or the buffer area surrounding the development footprint according to Appendix 5	Yes. The buffer area is shown as the project is a linear development.	Figure 3.1, Figure 3.2 and Appendix E
4.1.1.2	IBRA bioregion and IBRA subregions	Yes	Figure 3.1, Figure 3.2 and Appendix E
4.1.1.2	Mitchell landscapes	Yes	Figure 3.1, Figure 3.2 and Appendix E
4.1.1.2	Rivers and streams	Yes	Figure 3.1, Figure 3.2 and Appendix E
4.1.1.2	Wetlands	N/A. There are no important wetlands in the project area or buffer area.	N/A
4.1.1.2	Extent of native vegetation in the outer assessment circle or the buffer area surrounding the development footprint	Yes. The buffer area is shown as the project is a linear development.	Figure 3.1, Figure 3.2 and Appendix E
4.1.1.2	Any other landscape features that are required by the SEARs for assessment at a development site.	N/A. No other landscape features are required by the SEARs.	N/A
4.1.1.4	Any other regions within the outer assessment circle must be identified and shown on the Location Map.	Yes	Figure 3.1, Figure 3.2 and Appendix E
4.1.1.6	Any other Mitchell landscapes that occur within the outer assessment circle must be identified and shown on the Location Map.	Yes	Figure 3.1, Figure 3.2 and Appendix E
4.1.1.9	All other rivers, streams and estuaries that occur within the outer assessment circle, and their riparian buffer areas, must be identified and shown on the Location Map.	Yes	Figure 3.1, Figure 3.2 and Appendix E

Table D.2 Assessment of compliance with FBA requirements for the location map

FBA reference	Requirement	Comply?	BAR reference
4.1.1.12	Any other important and local wetlands that are adjacent to or downstream from the development site and within the outer assessment circle must be identified and shown on the Location Map.	N/A. There are no important wetlands in the project area or buffer area.	N/A
4.1.1.13	Important wetlands must also be separately identified and shown on the Site Map and the Location Map.	N/A. There are no important wetlands in the project area or buffer area.	N/A
4.1.1.14	The extent of native vegetation within the outer assessment circle, or the buffer area surrounding the development footprint, must be mapped onto digital aerial photography (such as ADS–40 imagery) or the best available imagery of the development site, and shown on the Location Map.	Yes. The buffer area is shown as the project is a linear development.	Figure 3.1, Figure 3.2 and Appendix E
4.1.1.17	All state or regionally significant biodiversity links that occur within the outer assessment circle must be identified and shown on the Location Map.	Yes	Figure 3.1, Figure 3.2 and Appendix E
4.1.1.18	Other landscape features should be mapped on both the Site Map and Location Map if this is a requirement of the SEARs.	N/A. No other landscape features are required by the SEARs.	N/A

Table D.3 Assessment of compliance with other mapping and data requirements of the FBA

FBA reference	Requirement	Comply?	BAR reference
5.1.1.1	The extent of native vegetation within the development site must be mapped onto digital aerial photography (such as ADS-40 imagery) or the best available imagery of the development site, using existing maps of native vegetation in the area and an assessment of the site. The capture scale should be 1:1,000 – 1:5,000, and not greater than 1:10,000.	Yes	Figures in Appendix E
Table 20	Map of Plant Community Type (PCT)s within the development site	Yes	Figure 3.4
Table 20	Map of condition class and subcategory (where relevant)	Yes	Figure 3.4
Table 20	Map of plot and transect locations relative to PCTs and condition class	Yes	Figure 3.4
Table 20	Map of EECs	N/A. The project area does not contain EECs.	N/A
Table 20	Plot and transect field data (MS Excel format)	Yes. This has been provided to OEH through the BioBanking Calculator.	N/A. This data has been uploaded to the biobanking calculator. A summary of plot data is provided in Table A.2.
Table 20	Plot and transect field data sheets	Yes.	Table A.1and Table A.2

Table D.3 Assessment of compliance with other mapping and data requirements of the FBA

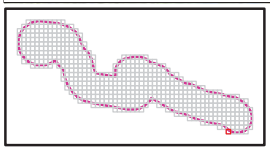
FBA reference	Requirement	Comply?	BAR reference
Table 20	Table of current site value scores for each vegetation zone within the development site	Yes.	Table 3.5
Table 20	Map of vegetation zones with a current site value score of <17	Yes	Figure 3.4
Table 20	Table of vegetation zones and landscape Tg values, particularly indicating where these have changed due to species exclusion	Yes	Vegetation zones are shown in Table 3.5. No ecosystem credit species were predicted by the BioBanking Calculator therefore therefore no Tg values were changed.
Table 20	Targeted survey locations	Yes	Figure 2.1
Table 20	Table detailing the list of species credit species and presence status on site as determined by targeted survey, indicating also where presence was assumed and/or where presence was determined by expert report	Yes	Table 3.6
6.5.1.17	The species polygon must: (a) be mapped using a satellite (ADS–40) or the best available ortho-rectified aerial image of the development site (b) use the unit of measurement identified for that species in the Threatened Species Profile Database (c) include the locations of the species or areas occupied by the species (d) contain the specific habitat feature or habitat component associated with that species on the development site (e) utilise GPS to confirm the location of the species polygon on the best available ortho-rectified aerial image of the development site.	Yes	Figure 6.3
Table 20	Species credit species polygons (as described in Paragraph 6.5.1.19)	Yes	Figure 6.3
Table 20	Table detailing species and habitat feature/component associated with species and its abundance on site (as described in Paragraph 6.5.1.19)	Yes	Table 3.6
Table 20	Species polygons for species that cannot withstand a loss	Yes	Figure 6.3
Table 20	Table of measures to be implemented before, during and after construction to avoid and minimise the impacts of the project, including action, outcome, timing and responsibility	Yes	Table 5.1
Table 20	Map of final project footprint, including construction and operation	Yes	Figure 3.1, Figure 3.2 and Appendix E
Table 20	Maps demonstrating indirect impact zones where applicable	Yes	Figure 3.1, Figure 3.2 and Appendix E
Table 20	Map of areas not requiring assessment	Yes	Figure 6.2
Table 20	Map of PCTs and species polygons not requiring offset	Yes	Figure 6.2
Table 20	Map of PCTs and species polygons requiring offset	Yes	Figure 3.4 Figure 6.3
Table 20	Map of the occurrence of the entity or impact that requires further consideration	Yes	Figure 4.1

Table D.3 Assessment of compliance with other mapping and data requirements of the FBA

FBA reference	Requirement	Comply?	BAR reference
5.2.1.8	The assessor is required to provide justification in the BAR of evidence used to identify a PCT at the development site. This includes: ... (c) a map showing the distribution of the PCTs on the development site.	Yes	Figure 3.4 Appendix A
5.2.1.9	The assessor must identify any threatened ecological communities that are associated with a PCT, and map the distribution of the ecological community on the development site.	N/A. EECs are absent from the project area and buffer area.	N/A
5.2.1.12	The distribution of PCTs classified under the saline wetland formation must be shown on the map.	N/A. Saline wetlands are absent from the project area and buffer area.	N/A
5.2.2.1	The assessor must use the map of PCTs referred to in Subsection 5.2.1, to identify and map the area of each PCT into a vegetation zone on the development site.	Yes	Figure 3.4
5.2.2.7	Vegetation zones that are in low condition, or are in a derived grassland form, or have a current site value score of less than 17 in accordance with Section 5.3, must be identified as a separate vegetation zone and shown on the map of vegetation zones.	Yes	Figure 3.4
10.3.1.3	The assessor may calculate a different future site value score for separate parts of a vegetation zone to allow for any variation in the impact of development across the vegetation zone. This includes where the impact of development will result in partial clearing of the native vegetation and includes areas such as asset protection zones and easements. The assessor must map these areas of the vegetation zone as a management zone and include this in the BAR.	N/A. The project does not require asset protection zones.	N/A

Appendix E

Individual site and location maps



Site map - 1

Berrima Rail Project
Biodiversity assessment report
Appendix E
Figure 1

T:\Jobs\2012\J12055 - Hume Coal Project EIS\Background information\GIS\02_Maps\2016_BREIS\BARIBRBAR013_SiteMap_20170130_02.mxd 30/01/2017

EMM HUMECOAL

Site map - 2

Berrima Rail Project
Biodiversity assessment report
Appendix E
Figure 2

T:\Jobs\2012\J12055 - Hume Coal Project EIS\Background information\GIS\02_Maps\2016_BREIS\BARIBRBAR013_SiteMap_20170130_02.mxd 30/01/2017

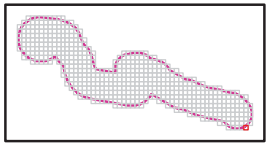
Site map - 3

Berrima Rail Project
Biodiversity assessment report
Appendix E
Figure 3

T:\Jobs\2012\J12055 - Hume Coal Project EIS\Background information\GIS\02_Maps\2016_BREIS\BARIBRBAR013_SiteMap_20170130_02.mxd 30/01/2017

Site map - 4

Berrima Rail Project
Biodiversity assessment report
Appendix E
Figure 4



T:\Jobs\2012\J12055 - Hume Coal Project EIS\Background information\GIS\02_Maps\2016_BREIS\BARIBRBAR013_SiteMap_20170130_02.mxd 30/01/2017

Site map - 5

Berrima Rail Project
Biodiversity assessment report
Appendix E
Figure 5

T:\Jobs\2012\J12055 - Hume Coal Project EIS\Background information\GIS\02_Maps\2016_BREIS\BARIBRBAR013_SiteMap_20170130_02.mxd 30/01/2017

Site map - 6

Berrima Rail Project

Biodiversity assessment report

Appendix E

Figure 6

T:\Jobs\2012\J12055 - Hume Coal Project EIS\Background information\GIS\02_Maps\2016_BREIS\BARIBRBAR013_SiteMap_20170130_02.mxd 30/01/2017

Site map - 7

Berrima Rail Project
Biodiversity assessment report
Appendix E
Figure 7

T:\Jobs\2012\J12055 - Hume Coal Project EIS\Background information\GIS\02_Maps\2016_BREIS\BARIBRBAR013_SiteMap_20170130_02.mxd 30/01/2017

Site map - 8

Berrima Rail Project
Biodiversity assessment report
Appendix E
Figure 8

T:\Jobs\2012\112055 - Hume Coal Project EIS\Background information\GIS\02_Maps\2016_BREIS\BARIBRBARO13_SiteMap_20170130_02.mxd 30/01/2017

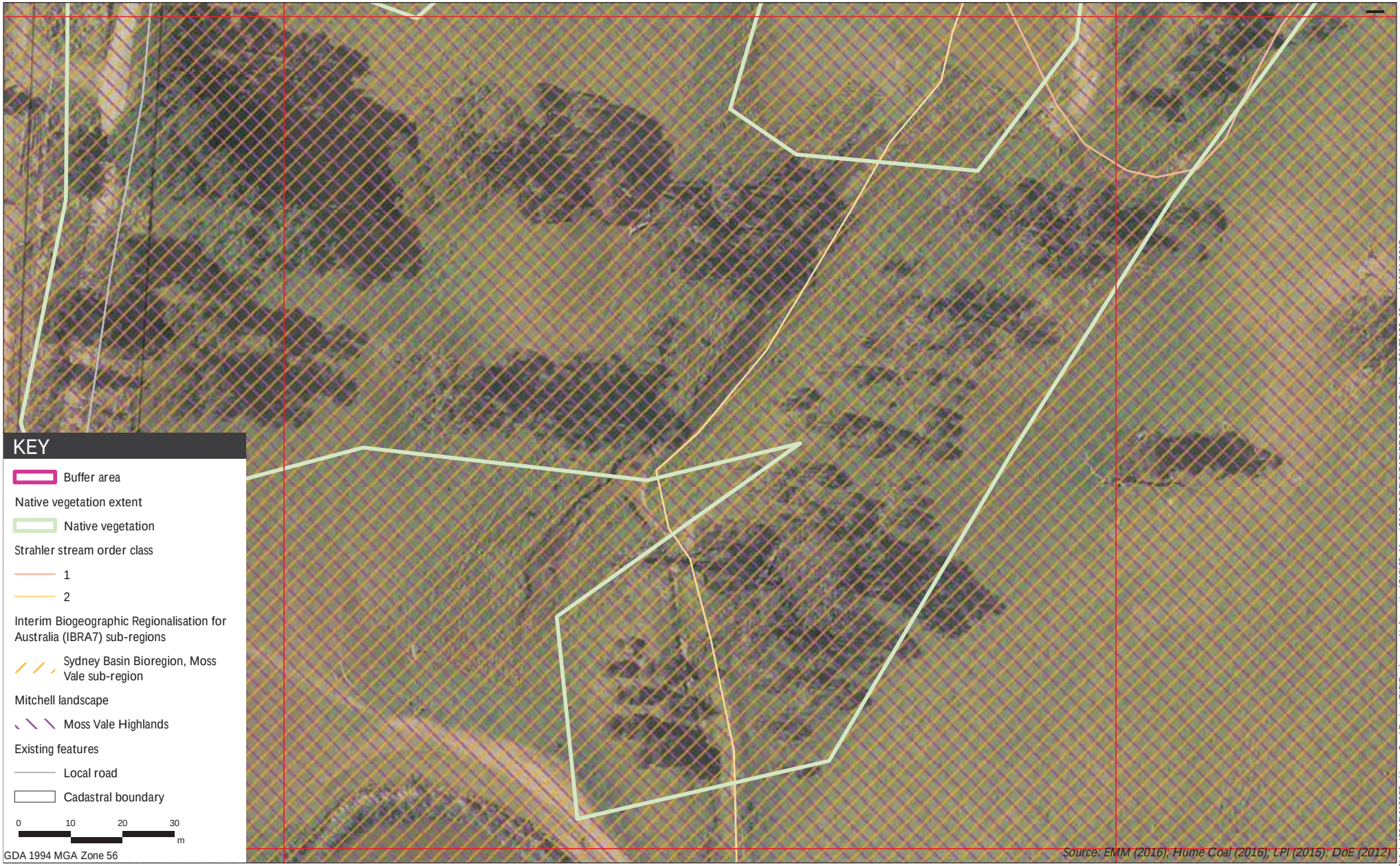
Site map - 9

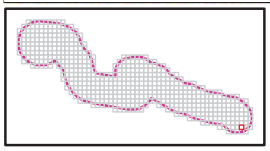
Berrima Rail Project
Biodiversity assessment report
Appendix E
Figure 9

T:\Jobs\2012\J12055 - Hume Coal Project EIS\Background information\GIS\02_Maps\2016_BREIS\BARIBRBAR013_SiteMap_20170130_02.mxd 30/01/2017

Site map - 10

Berrima Rail Project
Biodiversity assessment report
Appendix E
Figure 10



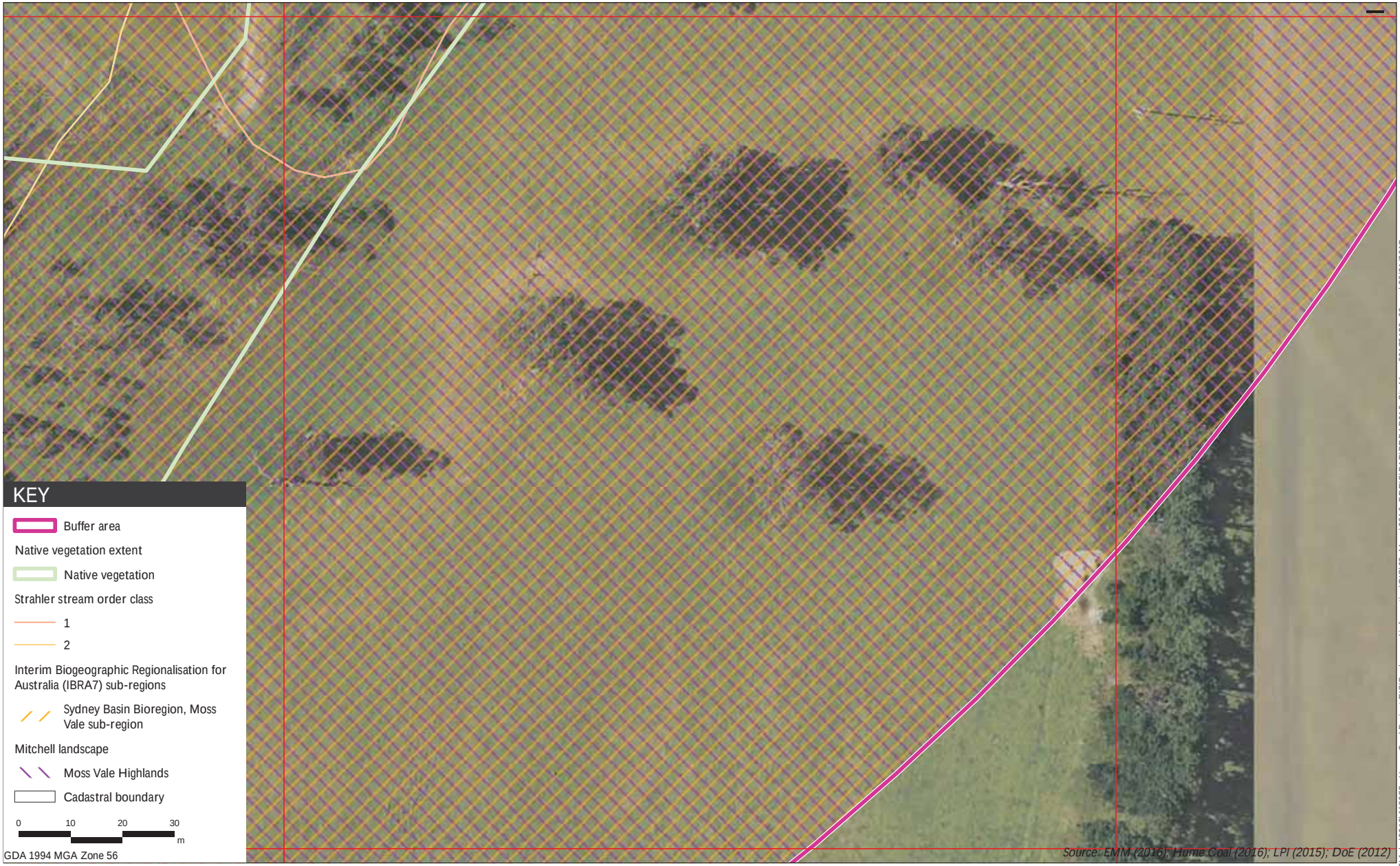


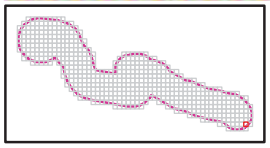
EMM HUMECOAL

T:\Jobs\2012\J12055 - Hume Coal Project EIS\Background information\GIS\02_Maps\2016_BREIS\BARIBRBARR013_SiteMap_20170130_02.mxd 30/01/2017

Site map - 11

Berrima Rail Project
Biodiversity assessment report
Appendix E
Figure 11



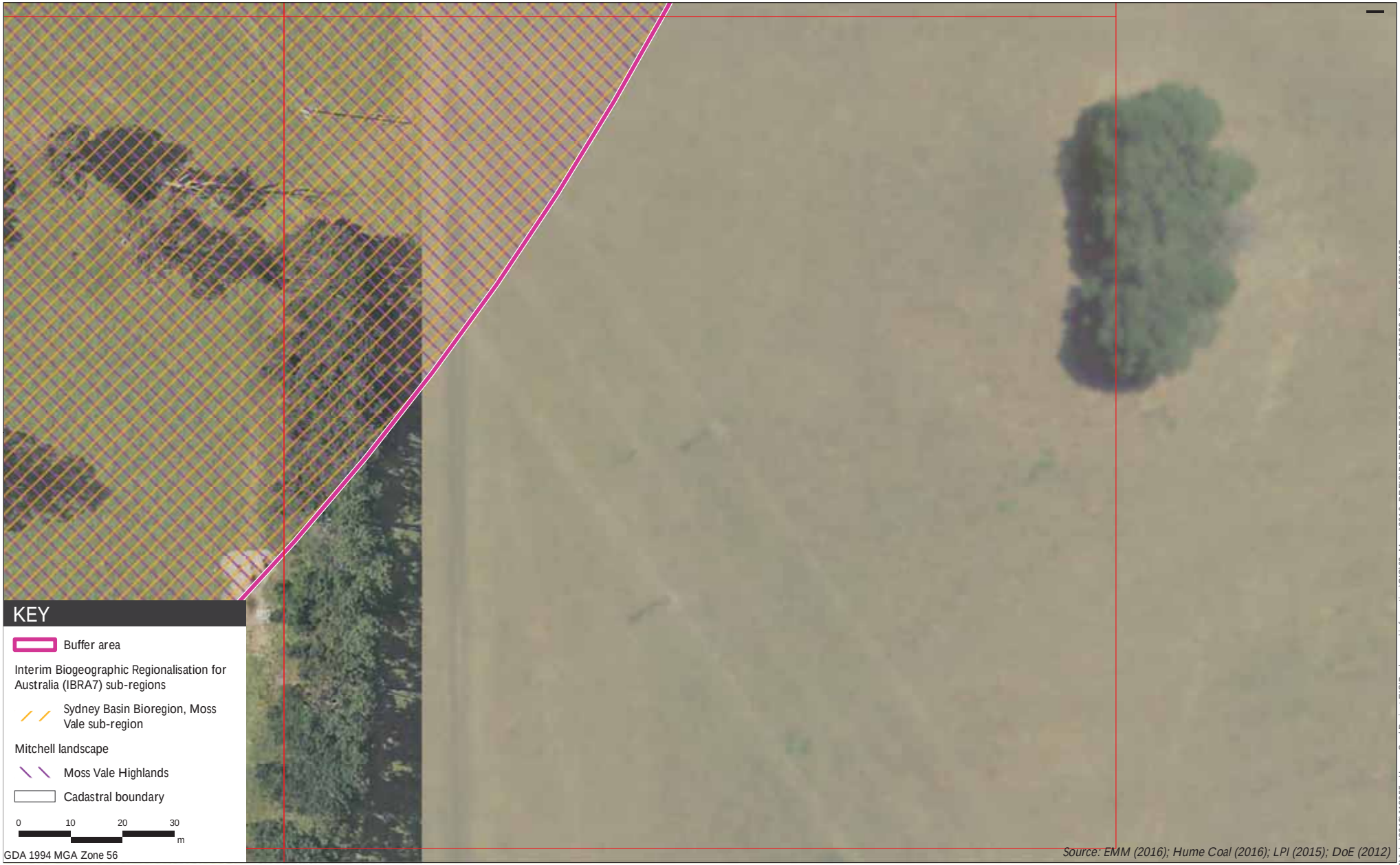


EMM HUMECOAL

Site map - 12

Berrima Rail Project
Biodiversity assessment report
Appendix E
Figure 12

T:\Jobs\2012\J12055 - Hume Coal Project EIS\Background information\GIS\02_Maps\2016_BREIS\BARIBRBAR013_SiteMap_20170130_02.mxd 30/01/2017



T:\Jobs\2012\J12055 - Hume Coal Project EIS\Background information\GIS\02_Maps\2016_BREIS\BARIBRBAR013_SiteMap_20170130_02.mxd 30/01/2017

Site map - 13

Berrima Rail Project
Biodiversity assessment report
Appendix E
Figure 13

T:\Jobs\2012\J12055 - Hume Coal Project EIS\Background information\GIS\02_Maps\2016_BREIS\BARIBRBAR013_SiteMap_20170130_02.mxd 30/01/2017

Site map - 14

Berrima Rail Project
Biodiversity assessment report
Appendix E
Figure 14

T:\Jobs\2012\J12055 - Hume Coal Project EIS\Background information\GIS\02_Maps\2016_BREIS\BARIBRBAR013_SiteMap_20170130_02.mxd 30/01/2017

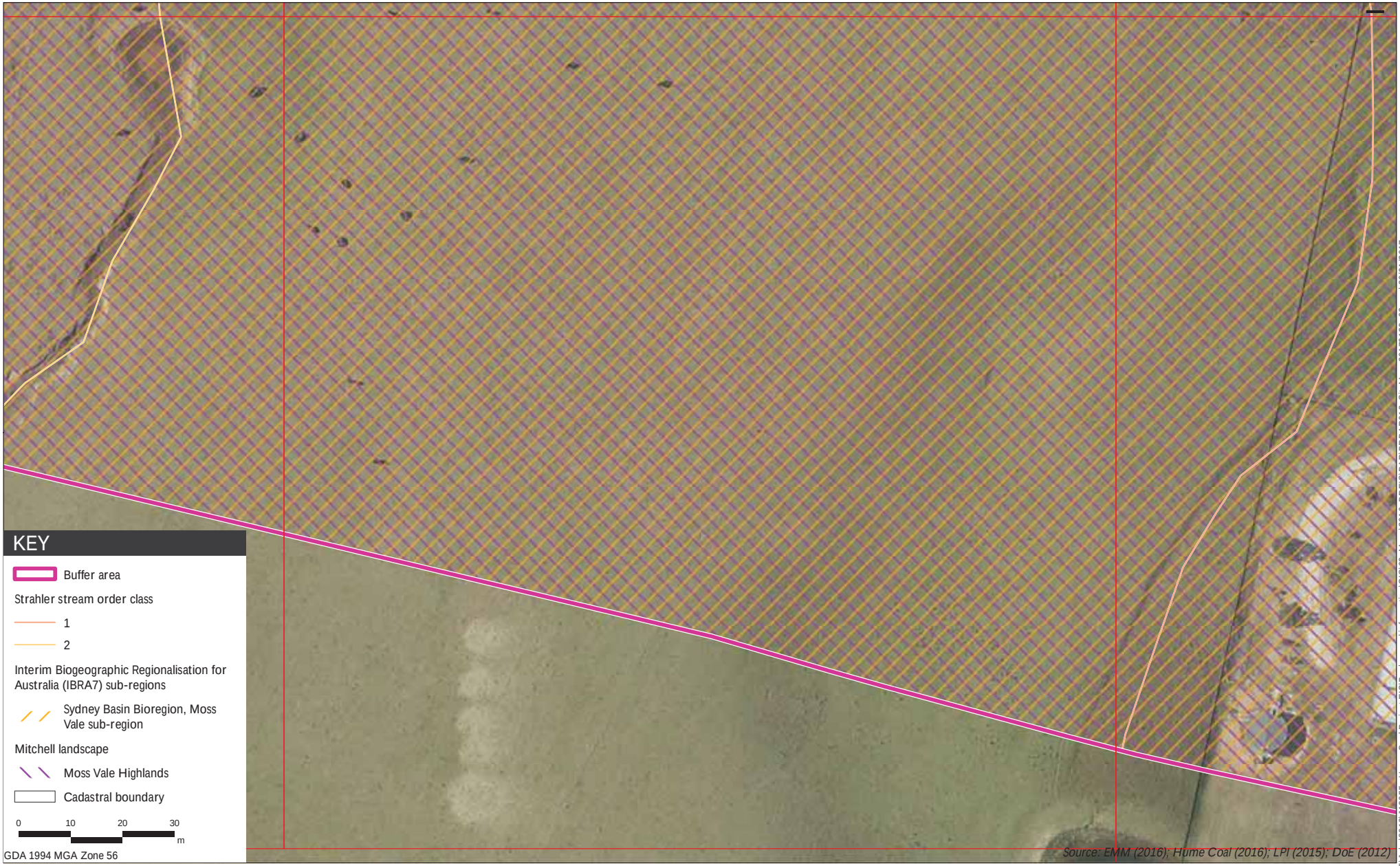
Site map - 15

Berrima Rail Project
Biodiversity assessment report
Appendix E
Figure 15

T:\Jobs\2012\J12055 - Hume Coal Project EIS\Background information\GIS\02_Maps\2016_BREIS\BARIBRBAR013_SiteMap_20170130_02.mxd 30/01/2017

Site map - 16

Berrima Rail Project
Biodiversity assessment report
Appendix E
Figure 16



T:\Jobs\2012\J12055 - Hume Coal Project EIS\Background information\GIS\02_Maps\2016_BREIS\BARIRBARO13_SiteMap_20170130_02.mxd 30/01/2017

Site map - 17

Berrima Rail Project
Biodiversity assessment report
Appendix E
Figure 17

T:\Jobs\2012\J12055 - Hume Coal Project EIS\Background information\GIS\02_Maps\2016_BREIS\BARIBRBARR013_SiteMap_20170130_02.mxd 30/01/2017

Site map - 18

Berrima Rail Project
Biodiversity assessment report
Appendix E
Figure 18

T:\Jobs\2012\J12055 - Hume Coal Project EIS\Background information\GIS\02_Maps\2016_BREIS\BARIBRBAR013_SiteMap_20170130_02.mxd 30/01/2017

Site map - 19

Berrima Rail Project
Biodiversity assessment report
Appendix E
Figure 19

T:\Jobs\2012\J12055 - Hume Coal Project EIS\Background information\GIS\02_Maps\2016_BREIS\BARIBRBAR013_SiteMap_20170130_02.mxd 30/01/2017

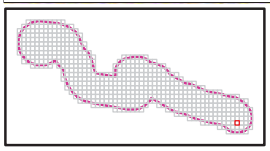
Site map - 20

Berrima Rail Project
Biodiversity assessment report
Appendix E
Figure 20

T:\Jobs\2012\J12055 - Hume Coal Project EIS\Background information\GIS\02_Maps\2016_BREIS\BARIBRBARO13_SiteMap_20170130_02.mxd 30/01/2017

Site map - 21

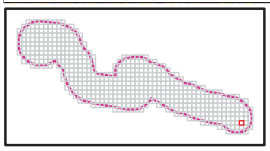
Berrima Rail Project
Biodiversity assessment report
Appendix E
Figure 21



EMM HUMECOAL

Site map - 22

Berrima Rail Project
Biodiversity assessment report
Appendix E
Figure 22

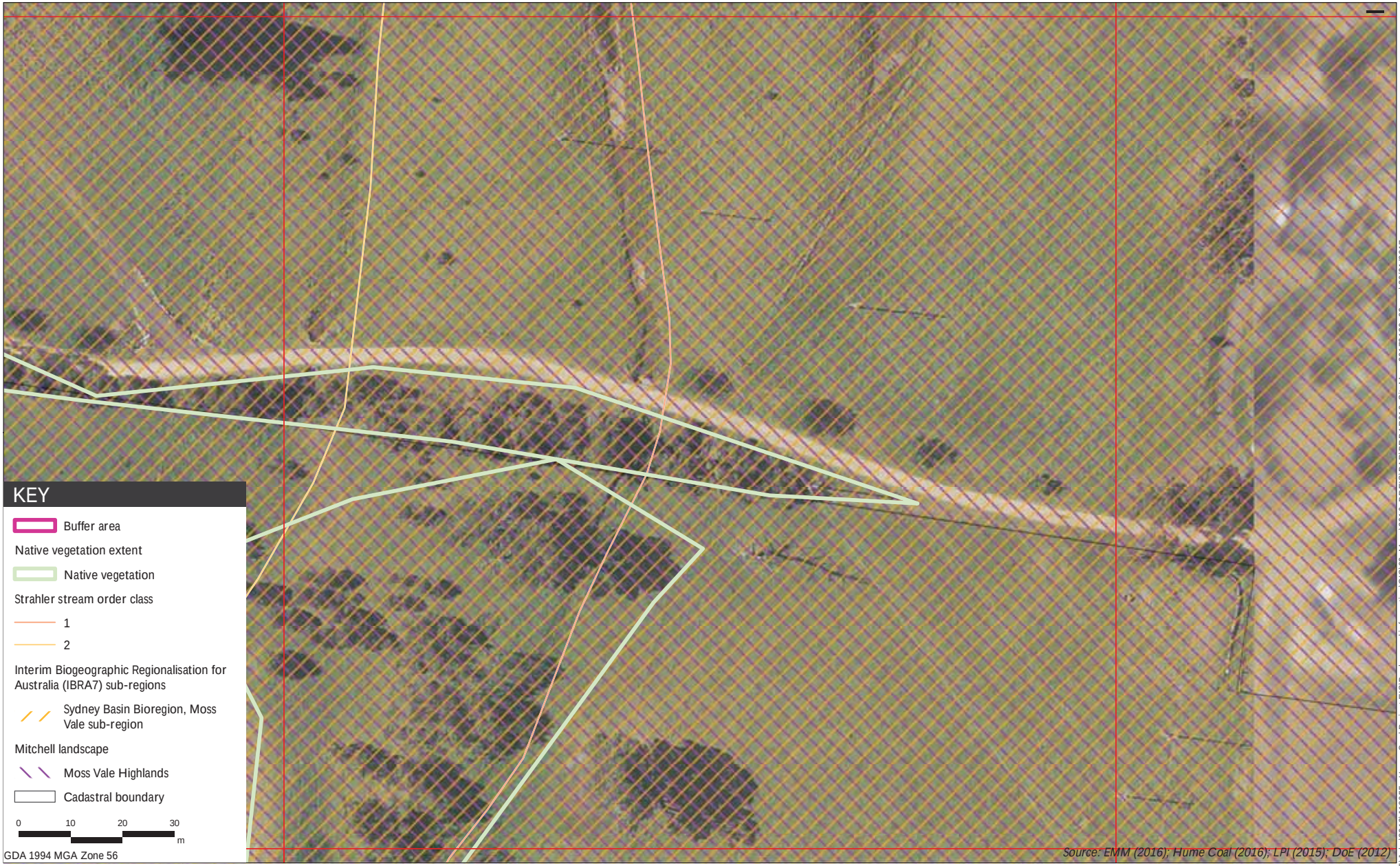


EMM HUMECOAL

T:\Jobs\2012\J12055 - Hume Coal Project EIS\Background information\GIS\02_Maps\2016_BREIS\BARIBRBARO13_SiteMap_20170130_02.mxd 30/01/2017

Site map - 23

Berrima Rail Project
Biodiversity assessment report
Appendix E
Figure 23



T:\Jobs\2012\J12055 - Hume Coal Project EIS\Background information\GIS\02_Maps\2016_BREIS\BARIBRBARO13_SiteMap_20170130_02.mxd 30/01/2017

Site map - 24

Berrima Rail Project
Biodiversity assessment report
Appendix E
Figure 24

T:\Jobs\2012\J12055 - Hume Coal Project EIS\Background information\GIS\02_Maps\2016_BREIS\BARIBRBAR013_SiteMap_20170130_02.mxd 30/01/2017

Site map - 25

Berrima Rail Project
Biodiversity assessment report
Appendix E
Figure 25

T:\Jobs\2012\J12055 - Hume Coal Project EIS\Background information\GIS\02_Maps\2016_BREIS\BARIBRBARR013_SiteMap_20170130_02.mxd 30/01/2017

Site map - 26

Berrima Rail Project
Biodiversity assessment report
Appendix E
Figure 26