

Appendix C

Ecology study



MOUNT PLEASANT PROJECT MODIFICATION

Ecological Assessment

For:

COAL & ALLIED OPERATIONS PTY LIMITED

September 2010

Final Report

Cumberland Ecology

PO Box 2474, Carlingford Court 2118



Report No. 8124RP5

The preparation of this report has been in accordance with the brief provided by the Client and has relied upon the data and results collected at or under the times and conditions specified in the report. All findings, conclusions or recommendations contained within the report are based only on the aforementioned circumstances. The report has been prepared for use by the Client and no responsibility for its use by other parties is accepted by Cumberland Ecology.

Approved by:	David Robertson
Position:	Project Director
	Dane Robertson
Signed:	
Date:	30 September, 2010

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INTRODUCTION

Cumberland Ecology has been commissioned by EMGA Mitchell McLennan on behalf of Coal & Allied Operations Pty Limited (Coal & Allied) to prepare an ecological assessment of the proposed Mount Pleasant Project modifications. Coal & Allied is seeking approval to modify the Mount Pleasant Project under section 75W of the New South Wales (NSW) *Environmental Planning and Assessment Act 1979* (EP&A Act). Lands within the Mount Pleasant Project area that would be subject to section 75W modification are referred to hereafter as the "modification areas".

The purpose of this report is to describe the existing ecological values and to assess the potential impacts from the proposed modifications. Although this report assesses potential impacts to all native flora and fauna, it focuses on species, populations and communities listed under the NSW *Threatened Species Conservation Act 1995* (TSC Act). Any flora and fauna Matters of National Environmental Significance (MNES), as listed under the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act), potentially impacted by the Project are assessed in a separate report *Mount Pleasant Project Ecological Matters of National Environmental Significance Impact Assessment* (Cumberland Ecology, 2010) prepared to accompany a referral under the EPBC Act.

METHODS

All available literature pertaining to ecology within the Mount Pleasant Project area was reviewed and relevant data collated. Potential knowledge gaps were identified from previous surveys to guide the design of the field programs for the proposed modifications.

Database analysis was conducted for the locality using both the Department of Environment Climate Change and Water Atlas of NSW Wildlife Database (DECCW, 2009) and Department of Environment, Water, Heritage and Arts Protected Matters Search Tool (DEWHA, 2010). The Atlas search was used to generate records of threatened flora and fauna species listed under the TSC Act within the Muswellbrook Local Government Area and within a 10km radius of the site. The Protected Matters search generated a list of potentially occurring flora, fauna and ecological communities listed under the EPBC Act within a 10km radius of the Mount Pleasant Project area. The lists generated from these databases were initially reviewed against available knowledge of the site to ascertain the likelihood of occurrence of threatened species to assist in designing surveys.



In addition to the surveys conducted for the Mount Pleasant Project Environmental Impact Statement (EIS) (ERM Mitchell McCotter, 1997), the Mount Pleasant Project area has been subject to a series of flora surveys conducted during 2006, 2007, 2008, 2009 and 2010. This data has been used to accurately map vegetation communities, assess seasonal and annual vegetation changes, and to compile a database of plant species found on the site. In the most recent flora surveys in 2010, Cumberland Ecology obtained additional flora data to assess the additional areas not subject to previous survey (eg within the conveyor/service corridor envelope) and to revise existing vegetation mapping to take account of recent name changes to Hunter Valley plant communities.

The 2010 flora surveys of the conveyor/service corridor envelope entailed the use of nested 20m x 20m quadrats inside 20m x 50m quadrats in dominant vegetation communities. This allowed an assessment under the BioBanking Scheme (DECC (NSW), 2008) if required. Targeted fauna surveys have been conducted in the wider Mount Pleasant Project area for the EIS and more recently in 2007 and 2009. The 2010 surveys of the conveyor/service corridor envelope also included an avifauna survey and fauna habitat assessment. The flora and fauna surveys conducted across the broader Mount Pleasant Project area have been undertaken over a range of years, seasons and conditions. Climatic conditions varied significantly with some surveys being conducted in the peak of drought while others were conducted following heavy rains. The resultant flora and fauna data for the subject land is consistent with results from other nearby sites in the upper Hunter Valley and provides a sound scientific basis to measure and predict the potential ecological impacts of the proposed modifications.

RESULTS

Vegetation Types

The landscape of the modification areas have been used for grazing since European settlement as evidenced by the cleared landscapes and continue to be used for these purposes. Notwithstanding this, a high proportion of the Mount Pleasant Project area, and all of the modification areas, has never been cultivated or sown with improved pasture. Consequently, the landscape of the modification areas is largely dominated by scattered patches of woodland of various sizes and ages, and broad expanses of what is referred to in this report as "Derived Native Grassland", that is grassland dominated by native plants that has been derived from the clearing of the original tree cover.

A number of recognisable open forest, woodland and grassland types occur within the proposed modification areas, but the most abundant native vegetation corresponds to an endangered ecological community (EEC) known under the TSC Act Final Determination as "White box, Yellow Box Blakely's Red Gum Woodland". For brevity in this report such vegetation is referred to as Box-Gum Grassy Woodland and Derived Native Grassland. This community is not considered to be the critically endangered ecological community (CEEC) listed under the EPBC Act as "White Box-Yellow Box-Blakely's Red Gum Grassy



Woodland and Derived Native Grassland" as the modification areas are dominated by Grey Box / White Box intergrades which are not included in the EPBC Act Final Determination. Intergrades are "hybrids with hybrids" that have occurred over possibly thousands of years as White Box and Grey Box distributions overlapped in pre-historic times. Currently in the upper Hunter Valley large areas are dominated largely or entirely by intergrades without either parent species present. Extensive testing by Cumberland Ecology with verification by the Royal Botanic Gardens indicated that all 78 specimens tested within and around the Mount Pleasant Project area were intergrades. No pure White Box trees have been identified.

The Box-Gum Grassy Woodland and Derived Native Grassland EEC is a large composite plant community that occurs from Victoria to Southern Queensland and includes a suite of constituent communities. The following variants of the State Box-Gum Grassy Woodlands and Derived Native Grasslands predominate across the modification areas:

- Upper Hunter White Box–Ironbark Grassy Woodland;
- Grey Box/White Box Intergrade Grassy Woodland;
- > Grey Box/White Box Intergrade–Spotted Gum Grassy Woodland; and
- > Derived Native Grassland (from Box-Gum EEC).

Several other vegetation communities also occur within the modification areas including:

- > Central Hunter Ironbark Spotted Gum Forest (EEC under the TSC Act);
- Narrabeen Footslopes Slaty Box Woodland (EEC under the TSC Act);
- Hunter Floodplain Red Gum Woodland Complex (Preliminary Determined EEC under the TSC Act);
- > Upper Hunter Hills Exposed Ironbark Woodland;
- > Derived Native Grassland (other forest and woodlands);
- > Low Diversity Derived Native Grassland and Exotic Pasture; and
- > Tree and Shrub Plantations.

Descriptions are provided of each plant community within this report.

Flora Species

Over 300 flora species have been recorded on the Mount Pleasant Project area of which approximately 75 per cent are native. The flora is dominated by grasses (Poaceae) and other families of herbaceous ground cover plants. This reflects the fact that the forest and woodland communities across the site have a grassy or herbaceous understorey and also

the fact that grasslands are extensive. The majority of plant species detected in the wider Mount Pleasant Project area have been found to occur within the modification areas.

No threatened flora species have been identified within the modification areas.

Fauna Species

The vegetation within the modification areas provides potential habitat for a range of native vertebrate fauna species, including amphibians, reptiles, birds, bats and arboreal and terrestrial mammals. A suite of threatened fauna species has been recorded or are expected to occur within the modification areas and all of these species are predicted to utilise woodland and to a lesser extent grassland habitats within the modification areas. The threatened species detected or considered likely to utilise the modification areas include woodland birds, bats and non-flying mammals as follows:

- > Brown Treecreeper (*Climacteris picumnus*) (Vulnerable under the TSC Act);
- Grey-crowned Babbler (*Pomatostomus temporalis*) (Vulnerable under the TSC Act);
- > Speckled Warbler (*Pyrrholaemus saggitatus*) (Vulnerable under the TSC Act);
- > Diamond Firetail (Stagonopleura guttata) (Vulnerable under the TSC Act);
- > Varied Sittella (Daphoenositta chrysoptera) (Vulnerable under the TSC Act);
- > Black-chinned Honeyeater (*Melithreptus gularis*) (Vulnerable under the TSC Act);
- > Squirrel Glider (*Petaurus norfolcensis*) (Vulnerable under the TSC Act);
- Spotted-tailed Quoll (*Dasyurus maculatus*) (Vulnerable under TSC Act, Endangered under EPBC Act);
- Eastern Bent-wing Bat (*Miniopterus schreibersii oceanensis*) (Vulnerable under the TSC Act);
- Large-eared Pied Bat (Chalinolobus dwyeri) (Vulnerable under EPBC and TSC Acts);
- > Eastern Free-tail Bat (*Mormopterus norfolkensis*) (Vulnerable under the TSC Act);
- Little Bent-wing Bat (*Miniopterus australis*) (Vulnerable under the TSC Act);
- > Large-footed Myotis (*Myotis macropus*) (Vulnerable under the TSC Act); and
- Grey-headed Flying-fox (*Pteropus poliocephalus*) (Vulnerable under EPBC and TSC Acts).

MOUNT PLEASANT PROJECT MODIFICATION

These threatened species, which have the potential to occur within suitable habitats in the proposed modification areas, are typical for woodland and grassy open forest remnants in the upper Hunter Valley.

IMPACT ASSESSMENT

The primary impact from the proposed modifications will be the clearing of vegetation. 'Clearing of Native Vegetation' is listed as a Key Threatening Process and has been identified as a direct cause of the decrease in biodiversity (NSW Scientific Committee, 2004c). However, it should be noted that the proposed modifications relate to options of already approved infrastructure and may lead to reductions in clearing as discussed further below, should these options be pursued.

- 1. An envelope within which to construct an infrastructure area; and
- 2. An envelope within which to construct a conveyor/service corridor to transport product coal to the Bengalla Rail Spur as an alternative option to the State-approved rail facilities that connect directly to the Muswellbrook Ulan Rail Line.

A conservative worst case approach to the ecological impact assessment has been adopted in which it has been assumed that:

- the maximum areas of highest quality native vegetation will be cleared within the infrastructure and conveyor/service corridor envelopes; and
- > a 30m disturbance area has been included along the entire length of the conveyor/service corridor.

Table S.1 shows the comparative areas and types of vegetation communities to be cleared by the approved rail facilities and specific locations of infrastructure within the infrastructure area (as detailed in the EIS), versus the proposed modification components assuming the worst case alignment of the optional conveyor/service corridor and configuration of infrastructure within the infrastructure envelope. These are termed 'approved disturbance' and 'proposed disturbance' respectively. Approved for the purposes of this report relates to Development Consent DA 92/97.

Under the proposed worst case scenario, the proposed disturbance would require approximately 47.5ha of vegetation clearing compared to approximately 54.8ha of clearing that would be required for the approved project, resulting in a reduction in the clearing requirements by approximately 7.3ha. The proposed worst case scenario (refer to **Figure 6.2**) results in total disturbance of approximately 35.5ha of vegetation communities currently listed under the TSC Act, compared with approximately 41.6ha under the approved disturbance footprint.

Vegetation community	Approved disturbance (ha)	Proposed disturbance (ha)
Upper Hunter White Box–Ironbark Grassy Woodland (TSC EEC)	-	1.3
White Box/Grey Box Intergrade – Spotted Gum Grassy Woodland (TSC		
EEC)	-	-
White Box/Grey Box Intergrade Grassy Woodland (TSC EEC)	2	9.1
Central Hunter Ironbark - Spotted Gum - Grey Box Forest (TSC EEC)	-	0.9
Hunter Floodplain Red Gum Woodland Complex (TSC EEC)	0.2	0.2
Tree and Shrub Plantations	1.1	0.8
Upper Hunter Hills Exposed Ironbark Woodland	1.6	4.2
Derived Native Grassland (Box-Gum) (TSC EEC)	39.6	24.0
Grassland (Hunter Floodplain Red Gum Woodland Complex)	0.5	0.6
Grassland (Upper Hunter Hills Exposed Ironbark Woodland)	1.4	1.3
Low Diversity Derived Native Grassland and Exotic Pasture	8.4	5.1
Total	54.8	47.5

Table S.1VEGETATION COMMUNITIES POTENTIALLY IMPACTED BY APPROVEDAND PROPOSED DISTURBANCE

The removal of vegetation from within the modification areas is not considered to constitute a significant impact to the fauna that may potentially utilise these areas, due to the highly mobile nature of these species allowing them to be able to continue to forage and breed in the general locality outside the disturbance areas. The proposed disturbance footprint is not considered sufficiently extensive to cause population and/or genetic isolation as a result of fragmentation.

Indirect impacts are a result of secondary processes and often occur around the periphery of a development. They include such things as weed invasion, increases in feral animals, erosion, and changes in habitat connectivity. The potential for indirect impacts that would result from the conveyor/service corridor being preferred to the approved rail facilities and modified configuration of infrastructure within the infrastructure area envelope is considered minimal.



MITIGATION AND OFFET MEASURES

The DECCW has prepared principles for the use of biodiversity offsets. Foremost among these is the principle that impacts must be avoided first by using prevention and mitigation measures. This principle means that the ecological impacts of proposed developments should be managed as follows:

- Avoid: to the extent possible, developments should be designed to avoid or minimise ecological impacts;
- Mitigate: where certain impacts are unavoidable through design changes, mitigation measures should be introduced to ameliorate the ecological impacts of the proposed development; and
- Compensate: the residual impacts of the project should be compensated for in some way to offset what would otherwise be a net loss of habitat.

This report explains the way these points have been applied to manage the impacts of the Project.

The DECCW has well established principles (DECC 2008) regarding the assessment of potential ecological impacts of proposed developments and how they should be managed. Essentially, these principles can be categorised into: avoid, mitigate, and compensate.

Avoidance

Should the conveyor/service corridor option be pursued, the approved development footprint would reduce by approximately 7.3ha and this reduces the disturbance of vegetation communities currently listed under the TSC Act.

While the exact locations and hence impact areas of the of the required proposed modifications are yet to be finalised, avoidance of impacts to ecological sensitive areas will be considered as part of detailed design process to determine the final location for the infrastructure and conveyor/services corridor. Avoidance of State listed EECs and important fauna/flora habitats, where possible, will be considered high in the hierarchy of parameters when locating this infrastructure; other constraints to location of infrastructure considered will be include logistical, topographic and location of residences. These avoidance measures may enable a reduction in the worst case potential impacts on these EECs and fauna habitat assessed in this report.

Mitigation

Several mitigation measures will be undertaken as a result of the Mount Pleasant Project and associated modification areas. The mitigation measures applicable to the modification area are outlined below.

i Revegetation

Revegetation of disturbed areas below the conveyor/service corridor will be implemented as soon as practically possible with local native ground cover and shrub species to ensure the integrity and continuity of flora and fauna habitat within the area is rapidly reestablished. Where practical, topsoil will be translocated from disturbance areas to conserve the native seed bank of local ecological communities.

ii Pre-clearance and Translocation of Threatened Species and Important Habitat Attributes

Mitigation measures include pre-clearance surveys of forest and woodland areas to undergo removal to identify any threatened flora and fauna species or habitat within areas of impact. This provides an opportunity to avoid impacts to flora and fauna of conservation significance during clearing.

Where appropriate important habitat features such as bush-rock and hollow logs will be returned to disturbance areas following clearing in an attempt to reinstate some of the natural habitat structural diversity to encourage fauna use of the area. Details of the rehabilitation of the infrastructure area and conveyor/service corridor (should this option be pursued) upon decommissioning will be provided in the Rehabilitation and Environment Management Plan (REMP).

iii Monitoring and Management

Ecological management and monitoring will be in accordance with Rio Tinto Coal Australia's Health, Safety, Environment and Quality (HSEQ) Management System, which is certified to the international standard ISO:14001(2004). This will incorporate a Flora and Fauna Management Plan (FFMP) for the Mount Pleasant Project, inclusive of the modification areas. Plans and procedures for land use, bushfire management, erosion and sediment control, biodiversity management, disturbance and rehabilitation, and ground disturbance will also be included.

During the construction phase, pre-clearance surveys of relevant forest and woodland areas to be removed will be undertaken, for threatened flora and fauna species. Where practical, threatened species or important habitat attributes (such as sizable logs and salvaged tree hollows) will be relocated.

An ongoing monitoring programme will be implemented for the Mount Pleasant Project, inclusive of the modification areas. Identified monitoring locations associated with the construction and operation of the proposed modifications, will be included in the Annual Environmental Management Report (AEMR).

Details of the rehabilitation of the infrastructure area and conveyor/service corridor (should this option be pursued) upon decommissioning will be provided in the Rehabilitation and Environment Management Plan.

Compensation

The modified Mount Pleasant Project, should the conveyor option be pursued, would have a lesser impact than the approved project by approximately 7.3ha. As a result it is not considered necessary to provide compensatory measures to offset the potential impacts. Any flora or fauna requiring relocation following pre-clearance surveys will be placed in the nearest area of suitable habitat.

CONCLUSION

The landscape of the proposed modification areas has been used for grazing since European settlement and as a result has been heavily cleared and disturbed historically. Notwithstanding this, vegetation communities listed as EECs under the TSC Act are located within the modification areas, including but not limited to; Upper Hunter White Box - Ironbark Grassy Woodland, Grey Box/White Box Intergrade Grassy Woodland, Grey Box/White Box Intergrade Spotted Gum - Grassy Woodland and Derived Native Grassland (from Box-Gum Grassy Woodland).

To provide for flexibility in the detailed design of the infrastructure area and optional conveyor/service corridor, a conservative worst case approach to ecological impact assessment was adopted. Under the worst case scenario, the proposed disturbance comprises approximately 47.5ha of vegetation clearance versus approximately 54.8ha of clearance for the approved disturbances. The proposed worst case scenario would result in total disturbance of approximately 35.5ha of vegetation communities currently listed under the TSC Act compared with approximately 41.6ha under the approved disturbance footprint.

The DECCW principles on management of potential ecological impacts have been considered with the proposed modifications resulting in an approximate 7.3ha reduction in disturbance of vegetation communities, should the conveyor/service corridor option be pursued.

Technically, the proposed modification areas, should the conveyor option be pursued, will entail a slightly decreased ecological footprint and will require a reduction in the forest, woodland and grassland to be cleared that may form habitat for a range of native flora and fauna species.

Further avoidance measures will be considered during the detailed design process. Mitigation measures may include:

Threatened Species Management: any occurrences of threatened flora and fauna species will be translocated to an area of nearby suitable habitat, where considered appropriate, and nest boxes will be established where necessary to maintain an effective fauna monitoring program at RTCA; and

Pre-clearance surveys will be conducted within areas to be cleared and threatened flora and fauna detected will be translocated into suitable habitat where appropriate.

Chapter 1

Introduction

1.1 Purpose

Cumberland Ecology has been commissioned by EMGA Mitchell McLennan on behalf of Coal & Allied Operations Pty Limited (Coal & Allied) to conduct an ecological assessment of the proposed modification to the Mount Pleasant Project (the Project). An application for development consent for the Mount Pleasant Project was made in 1997 and supported by an Environmental Impact Statement (EIS) (ERM Mitchell McCotter, 1997). On 22 December 1999, the then Minister for Urban Affairs and Planning, granted Development Consent DA 92/97 to Coal & Allied under Part 4 of the *Environmental Planning and Assessment Act 1979* (EP&A Act) for the "Construction and operation of an open cut coal mine, coal preparation plant, transport and rail loading facilities and associated facilities" at Mount Pleasant. A figurative comparison of the approved project and the proposed modified Mount Pleasant Project can be seen in **Figure 1.1** and **Figure 1.2**. Lands within the Mount Pleasant Project area that could be potentially subjected to impacts under the section 75W modification are referred to hereafter as the "modification areas".

The purpose of this report is to describe the existing ecological values and to assess the potential impacts from the proposed modifications. Although this report assesses potential impacts to all native flora and fauna, it focuses on species, populations and communities listed under the NSW *Threatened Species Conservation Act 1995* (TSC Act). Any flora and fauna Matters of National Environmental Significance potentially impacted by the Project are assessed in a separate report *Mount Pleasant Project Ecological Matters of National Environmental Significance Impact Assessment* (Cumberland Ecology, 2010) prepared to accompany a referral under the *Environment Protection and Biodiversity Conservation Act* 1999.

Specifically, the objectives of the assessment process for this report are to:

- Describe and map vegetation communities within the modification areas, identifying any listed threatened communities;
- Identify and map the location of threatened flora and fauna species within the modification areas;
- Assess the likelihood that threatened flora and fauna species could occur within modification areas; and

Describe the types and extent of potential impacts on threatened communities and species arising from the development in the modification areas and provide a comparison to the potential impacts from the approved infrastructure that these options may replace.

1.2 Background

1.2.1 Site Location

The Mount Pleasant Project area is located approximately four kilometres (km) north-west of Muswellbrook in the Upper Hunter Valley of NSW. The Hunter Valley forms part of the Sydney Basin Bioregion, a large and complex area that extends from Batemans Bay in the south to Nelson Bay in the north and includes parts of the Blue Mountains. It incorporates all of the Hunter River Catchment.

The Mount Pleasant Project area is located to the north of and adjacent to Bengalla Mine and south of the township of Dartbrook. The Mount Pleasant Project area is generally bounded by the Muswellbrook – Ulan Rail Line in the south, Logues Lane and Kayuga Rd in the east, Dorset Rd in the north and Sandy Creek in the West.

The modification areas that involve ground disturbance include the infrastructure envelope and the conveyor/service corridor. The infrastructure envelope is located between Wybong Road and the South-west Out-of-Pit Emplacement and encompasses existing approved infrastructure (see **Figure 2.1**). The conveyor/service corridor extends from the south of the proposed infrastructure envelope to the existing Bengalla rail link (see **Figure 2.1**).

1.2.2 Site Description

The Mount Pleasant Project area, including the modification areas, sits on predominantly undulating hills on the western side of the Hunter River and consists of a mosaic of land previously cleared for agriculture and scattered areas of regrowth vegetation. Much of the land is presently used for agricultural purposes and where vegetation is present it typically represents recent regeneration and scattered remnant trees in grasslands. Several small ephemeral drainage lines are scattered throughout the modification areas and ultimately drain into the Hunter River. The general elevation is lowest in the south and rises to form a peak in the north adjacent to Wybong Road.

To the east of the Mount Pleasant Project area is the township of Muswellbrook, while extensive areas of agricultural land lie to the north and west (**Figure 1.1**).

1.2.3 Proposed Project Modifications

The proposed modifications of relevance to this assessment include:

- Provision of an infrastructure envelope for siting the mine infrastructure to provide flexibility during the detailed design and construction of the facilities in place of the specific locations detailed in the EIS; and
- Provision of an optional conveyor/service corridor between the Mount Pleasant Project area and the adjoining Bengalla Mine to the south as an alternative to the approved rail line and rail loop and loader facilities, including loadout conveyor and bin (collectively referred to herein as the rail facilities). Only one of the options (i.e. conveyor/service corridor or the rail facilities) would be constructed. The conveyor/service corridor is within an envelope to provide flexibility during detailed design.

1.3 Terms and Abbreviations

This report uses the terms and abbreviations outlined in Table 1.1:

Term / Abbreviation	Meaning
AEMR	Annual Environmental Management Report
CMA	Catchment Management Authority;
CEEC	Critically Endangered Ecological Community listed under the EPBC Act;
DA	Development Application;
DECCW	NSW Department of Environment and Climate Change and Water;
DEWHA	Department of Environment, Water, Heritage and the Arts;
DUAP	Department of Urban Affairs and Planning;
EEC	Endangered Ecological Community listed under the TSC Act
EIS	Environmental Impact Statement;
EMS	Environmental Management System;
EP&A Act	NSW Environmental Planning and Assessment Act 1979;
EPBC Act	Commonwealth Environment Protection and Biodiversity Conservation Act 1999;
FFMP	Flora and Fauna Management Plan;

Table 1.1 TERMS AND ABBREVIATIONS USED IN THIS REPORT



Term / Abbreviation	Meaning
LGA	Local Government Area;
Locality	The area within 10km of Mount Pleasant Project area;
Modification areas	Lands that are the subject of the proposed modifications;
Mount Pleasant Project (the Project)	The approved Mount Pleasant Mine which is undergoing proposed modifications as per the subject of this report;
Mount Pleasant Project area (the Project area)	The area that all development and mining operational work associated with the Mount Pleasant Project will be conducted within as shown in Figure 1.2 of this report;
Region	Refers to the Interim Biogeographic Regionalisation for Australia (IBRA) Bioregion which the Mount Pleasant Project area sits within; in this case the Sydney Basin Bioregion;
SEPP 44	State Environmental Planning Policy 44 (Koala Habitat Protection);
Threatened flora and fauna	Refers to communities, populations and species listed as Vulnerable or Endangered under the EPBC and TSC Acts; and
TSC Act	NSW Threatened Species Conservation Act 1995.

Table 1.1 TERMS AND ABBREVIATIONS USED IN THIS REPORT









Coordinate System: MGA Zone 56 (GDA 94)

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Methodology

2.1 Literature Review

The Mount Pleasant Project area has been extensively studied since the 1990s. For the purposes of this report, all available literature pertaining to ecological aspects within the Mount Pleasant Project area was reviewed. This literature was then analysed in order to:

- > Collate all available existing data; and
- Identify any potential gaps in previous surveys to guide the design of the field program for the proposed modification.

The documents reviewed in the desktop assessment are listed in **Table 2.1** below:

Table 2.1 DESKTOP REVIEW DOCUMENTS

Author	Year	Document Title
ERM Mitchell McCotter	1997	Mount Pleasant Mine Environmental Impact Assessment
Cumberland Ecology for Coal & Allied	Nov-06	Proposed Mount Pleasant Open Cut Mine – Flora and Fauna Assessment
Cumberland Ecology for HLA-Envirosciences	May-07	Mount Pleasant Ecology Gap Analysis Report
Cumberland Ecology for Coal & Allied	Oct-07	Mount Pleasant Mine – Survey and Analysis of Box-Gum Grassy Woodland
The Envirofactor for DEWHA	Jun-08	Mount Pleasant Mine – Review of Survey and Analysis Report on Box-Gum Grassy Woodland
Cumberland Ecology for Coal & Allied	Summer 08/09	Mount Pleasant Project – Flora and Fauna Report

2.2 Database Analysis

Database analysis was conducted for the locality using both the Department of Environment Climate Change and Water (DECCW) Atlas of NSW Wildlife Database (DECCW, 2010) and DEWHA Protected Matters Search Tool (DEWHA, 2010). The Atlas search was used to generate records of threatened flora and fauna species listed under the TSC Act within the Muswellbrook LGA and within a 10km radius of the Project area. The Protected Matters search generated a list of potentially occurring flora, fauna and ecological communities listed under the EPBC Act within a 10km radius of the Project area. The lists generated from these databases were initially reviewed against available knowledge of the site to ascertain the likelihood of occurrence of threatened species within the modification areas.

2.3 Vegetation Mapping

Extensive vegetation surveys have been conducted within the Mount Pleasant Project area over several studies across a number of years. This large amount of survey effort has enabled the development of a detailed vegetation map for the Mount Pleasant Project area. Cumberland Ecology conducted additional vegetation surveys to revise and update this existing vegetation mapping in early 2010 and to map sections of the Project area that had previously not been mapped, including the modification areas.

2.4 Flora Survey

Recent flora surveys of the modification areas were undertaken in an effort to determine the type and quality of vegetation as well as to conduct targeted threatened species searches throughout the area. Two nested 20m x 20m quadrats inside 20m x 50m quadrats were completed in the dominant vegetation communities in the conveyor/service corridor envelope on 19 March 2010. This allowed an assessment of these areas under the BioBanking methodology (DECC 2009) in the event that offsets and BioBanking surveys of offset areas were needed.

All vascular plants recorded or collected were identified using keys and nomenclature provided in Harden (Harden 1990-1993). Other references were used to assist identification, particularly for specimens (Brooker and Kleinig, 2006, Richardson *et al*, 2006). Where known, taxonomic and nomenclatural changes have been incorporated into the results, as derived from PlantNET (Botanic gardens Trust, 2010).

To confirm the identity of some dominant tree species for the purposes of identifying the EECs, specimens (leaves, buds, capsules, branches and bark) from more than 100 trees were sent to the Royal Botanic Gardens. This was particularly important to do for "Box" eucalypts because all such trees appeared to exhibit intermediate characteristics between White Box and Grey Box. Some individual trees were problematic to sample as they lacked buds and/or capsules. For this reason, some trees were not identified by the Royal

Botanic Gardens Herbarium. However, 78 Box trees from across the Project area and buffer lands were verified, giving a substantial representative sample.

An extensive amount of previous flora survey has been completed within the Mount Pleasant Project area across a broad temporal range as indicated by the survey reports in **Table 2.2** below and **Figure 2.1**. Vegetation survey has also been undertaken in lands adjacent to the Mount Pleasant Project area. This work provides a substantial database of information relevant to, and providing a solid context for, the flora and fauna of the proposed modification areas.

Survey	Dates	Survey Effort
ERM Mitchell McCotter	November 1994, July 1995, November 1996 and February 1997 (dates not specified)	General Flora survey , no comment on survey effort
Cumberland Ecology for Coal & Allied	6-7 November, 2006	Eleven 20m x 20m quadrats, targeted flora surveys
Cumberland Ecology for HLA- Envirosciences	7-11 May, 21-25 May, and 28-31 May, 2007	Sixty eight 20m x 20m quadrats within the Mount Pleasant Project area. Fifteen 20m x 20m quadrats outside the Mount Pleasant Project area in the wider locality Random meander, transect and targeted threatened flora searches
The Envirofactor for DEWHA	15 -16 March, 2008	Eleven 20m x 50m quadrats
Cumberland Ecology for Coal & Allied	15 December, 2008 and 2-4 February, 2009	Fourteen 20m x 50 m quadrats within the Mount Pleasant Project area and surrounding buffer lands
		Random meander, transect and targeted threatened flora searches
Cumberland Ecology for Coal & Allied	9-10 March, 2010	Six 20m x 20m quadrats in the buffer lands surrounding Mount Pleasant project area
		Targeted threatened flora searches
Cumberland Ecology for Bengalla Mine	19 March, 2010	Two 20m x 20m Two nested 20m x 20m quadrats inside 20m x 50m quadrats in proposed modification areas.
		Random meander, transect and targeted threatened flora searches

Table 2.2 FLORA SURVEY EFFORT



2.5 Fauna Survey

An extensive amount of previous fauna survey has been completed within the Mount Pleasant Project area across a broad temporal range as indicated by the survey reports in **Table 2.3** and **Figure 2.2**.

Recent fauna habitat surveys were undertaken in an effort to determine the type of fauna that uses the proposed conveyor /service corridor envelope and the quality of fauna habitat that is present within these areas. Habitat assessments were undertaken throughout the proposed conveyor /service corridor envelope and all incidental species observations were recorded within the area. No separate fauna survey was undertaken in the modification area and is not considered necessary based on the likelihood of occurrence of fauna species within the vegetation communities and the low level of clearing requirements compared to the rail line/loop. **Table C.1** consolidates the survey effort for all techniques across the various survey periods and compares their adequacy against DECCW survey guidelines (DEC, 2004). In summary, it is considered that adequate survey has been completed and that the data collected for the Mount Pleasant Project area is relevant for the proposed modification area.

Survey	Dates	Technique	Survey Effort
ERM Mitchell McCotter	21 - 24 November 1994,	Amphibians	
	20 - 21 July 1995 and	Targeted habitat active search	No details reported
	30 November 1995	Reptiles	
		Targeted habitat active search	No details reported
		Diurnal Birds	
		Bird point counts	At least 4 hours, actual time not reported
		Nocturnal Birds	
		Spotlighting	3 nights
		Call playback	3 nights
		Non-flying Mammals	
		Cage traps	3 trap nights
		Terrestrial Elliot traps	150 trap nights
		Hair tubes	151 trap nights
		Spotlighting	3 nights
		Search for scats and signs	Throughout survey period
		Bats	
		Ultrasonic call recording	2 nights

Table 2.3 FAUNA SURVEY EFFORT

Cumberland Ecology

16 - 20 October and

Amphibians



Survey	Dates	Technique	Survey Effort
for Coal & Allied 6 - 9 November 200	6 - 9 November 2006	Night call playback	Targeted calls to Green and Golden Bell Frog.
		Night habitat search of damp and watery sites	Calls noted at 3 dams
		Night watercourse search	Searches in surrounding aquatic veg
		Catch and release	Tadpoles caught and identified
		Opportunistic	Frog calls recorded during field surveys
		Reptiles	
			30 minutes
		Opportunistic	Reptiles recorded between quadrats
		Diurnal Birds	
		Area search	18 hours
		Nocturnal Birds	
		Habitat search	1.5 hours
		Spotlighting	10 hours (2 hours for 5 nights)
		Non-flying Mammals	
		Terrestrial hair tubes	1500 trap nights
		Arboreal hair tubes	1500 trap nights
		Spotlighting	10 hours (2 hours for 5 nights)
		Call playback	Squirrel Glider (30-45 minutes at given sampling points for 3 nights)
		Bats	
		Ultrasonic call recording	2 units for 10 nights
Cumberland Ecology	2-11 February 2009	Amphibians	
for Coal & Allied		Systematic day habitat search	2 hours
		Night habitat search of damp	2 hours
		and watery sites	
		Night watercourse search	2 hours
		Reptiles	

Table 2.3 FAUNA SURVEY EFFORT



Survey	Dates	Technique	Survey Effort
		Habitat search	x 30 minutes (across 5 separate days)
		Pitfall traps with drift nets	150 trap nights (12 traps for 8 nights, 6 traps for 5 nights, 6 traps for 4 nights)
		Spotlighting	2.5 hours (across five separate nights)
		Diurnal Birds	
		Area search	3 days
		Water source census	30 minutes
		Nocturnal Birds	
		Call playback	6 nights (30 minutes each night, 1 site per night)
		Day habitat search	Throughout survey period
		Non-flying Mammals	
		Terrestrial Elliott traps	350 trap nights
		Arboreal Elliott traps	510 trap nights
		Pitfall traps with drift nets	150 trap nights
		Terrestrial Hair tubes	600 trap nights
		Arboreal hair tubes	600 trap nights
		Spotlighting on foot	10 hours (5 x 2 hours per night)
		Spotlighting from vehicle	5 hours (5 x 1 hours per night)
		Call playback	6 nights
		Search for scats and signs	5 hours
		IR cameras	12 survey nights
		Collection of predator scats	Throughout survey period
		Bats	
		Harp trapping	6 trap nights
		Ultrasonic call recording	7 nights
		Trip lining	1 night
Cumberland Ecology	15 – 17 February 2010	Amphibians	
for Bengalla Mine		Habitat Assessment	3 days
		Spotlighting	2 hours

Table 2.3 FAUNA SURVEY EFFORT

MOUNT PLEASANT PROJECT MODIFICATION

CUMBERIAND ECOLOGY

Survey	Dates	Technique	Survey Effort
		Reptiles	
		Habitat Assessment	3 days
		Spotlighting	2 hours
		Diurnal Birds	
		Habitat Assessment	3 days
		Area Search	3 days
		Targeted bird transects	4 hours
		Nocturnal Birds	
		Habitat Assessment	3 days
		Spotlighting	2 hours
		Non-flying Mammals	
		Habitat Assessment	3 days
		Spotlighting	2 hours
		IR cameras	15 Survey nights
		Bats	
		Ultrasonic call recording	4 nights

Table 2.3 FAUNA SURVEY EFFORT

2.6 Adequacy of Surveys

As indicated in **Table 2.2** and **Table 2.3** extensive flora and several fauna surveys have been conducted throughout the Project area and surrounds in an effort to determine the quality and nature of the vegetation and ecological values of the area. These surveys were conducted over a range of seasons and conditions, ensuring that all seasonal and climactic limitations to the successful detection of flora and fauna groups were minimised. Climatic conditions varied significantly with some surveys being conducted during severe drought conditions, whilst other surveys were conducted following heavy rains.

The most recent flora and fauna surveys were undertaken to supplement existing survey data. Overall, given the understanding of the type and nature of flora and fauna within the Project area, it is considered that the level of flora and fauna survey conducted within the modification areas is adequate to assess the likelihood of threatened species to occur within the proposed modification areas and any potential impacts that may occur as a result of these impacts.

MOUNT PLEASANT PROJECT MODIFICATION







 $_{Chapter}$ 3

Results

3.1 Introduction

The vegetation across the Central Hunter Valley has been mapped by the Hunter-Central Rivers Catchment Management Authority (CMA) (Peake, 2006) across the entire central Hunter Valley and this mapping includes the Mount Pleasant Project area. Additional mapping studies have been conducted across the Mount Pleasant Project area as part of vegetation studies commissioned by Coal & Allied, these studies have been conducted at a finer and more accurate scale across the Project area and adjacent areas only, providing a more detailed picture of vegetation than the regional mapping of Peake.

The vegetation communities that occur within the modification areas are shown in **Figure 3.1**. The conservation status and area of each community within the modification areas is provided in **Table 3.1**. Where appropriate, the names used to describe these communities follow those used in the CMA mapping study.

The predominant vegetation element within the modification areas is grassland that has been derived from the clearing of the original woodland and forest communities. This grassland is dominated by a variety of native grass and forb species however at certain locations many exotic species are also present, as is typical of grazing lands. The vegetation within the modification areas also includes hybrid variants of the State listed Box-Gum Grassy Woodland and Derived Native Grassland. This community is not considered to be the critically endangered ecological community (CEEC) listed under the EPBC Act as "White Box-Yellow Box-Blakely's Red Gum Grassy Woodland and Derived Native Grassland" as the modification areas are dominated by Grey Box / White Box intergrades which are not included in the EPBC Act Final Determination. Intergrades are "hybrids with hybrids" that have occurred over possibly thousands of years as White Box and Grey Box distributions overlapped in pre-historic times. Currently in the upper Hunter Valley, large areas are dominated largely or entirely by intergrades without either parent species present. Extensive testing by Cumberland Ecology with verification by the Royal Botanic Gardens indicated that all 78 specimens tested within and around the Project area were intergrades. No pure White Box trees have been identified.
Vegetation Community	Approved Rail Facilities (ha)	Approved Infrastructure (ha)	Worst Case Conveyor (ha)	Worst case Modified Infrastructure (ha)
Upper Hunter White Box/–Ironbark Grassy Woodland (EEC)	-	-	1.3	
White Box/Grey Box Intergrade – Spotted Gum Grassy Woodland (EEC)	-	-	-	-
White Box/Grey Box Intergrade Grassy Woodland (EEC)	1.6	0.4	0.1	9.0
Central Hunter Ironbark - Spotted Gum - Forest (EEC)	-	-	0.9	-
Hunter Floodplain Red Gum Woodland Complex (EEC)	0.2	-	0.2	-
Tree and Shrub Plantations	-	1.1	0.8	-
Upper Hunter Hills Exposed Ironbark Woodland	1.6		4.2	-
Derived Native Grassland (Box – Gum)(EEC)	14.9	24.7	4.2	19.8
Grassland (Hunter Floodplain Red Gum Woodland Complex)	0.5	-	0.6	-
Grassland (Upper Hunter Hills Exposed Ironbark Woodland)	1.4	-	1.3	-
Low Diversity Derived Native Grassland and Exotic Pasture	3.4	5.0	2.7	2.4
Total	23.6	31.2	16.3	31.2
Grand Total		54.8		47.5

Table 3.1AREAS OF VEGETATION CLEARED FOR APPROVED AND MODIFIEDINFRASTRUCTURE COMPONENTS OF THE PROJECT

3.2 Box-Gum Grassy Woodlands and Derived Native Grasslands

3.2.1 Upper Hunter White Box-Ironbark Grassy Woodland

Status: Endangered Ecological Community (TSC Act)

This is an open woodland community that occurs on gently undulating slopes and hills on clay and earth soils. Canopy species characteristic of this community include *Eucalyptus crebra* (Narrow-leaved Ironbark), *Eucalyptus albens x moluccana* (White Box/ Grey Box intergrade) and *Eucalyptus moluccana x albens* (Grey Box/White Box intergrade). Other

canopy species that occur within this community include, *Brachychiton populneus* ssp. *populneus* (Kurrajong) and *Corymbia maculata* (Spotted Gum).

Common understorey species include Notelaea microcarpa var. microcarpa (Native Olive), Myoporum montanum (Water bush), and Maireana microphylla (Small-leaved Bluebush). The groundcover is diverse and is generally dominated by grasses and forbs, such as Aristida ramosa (Three-awned Wiregrass), Cymbopogon refractus (Barbed Wire Grass), Austrostipa verticillata (Slender Bamboo Grass), Chloris ventricosa (Windmill Grass), Austrodanthonia fulva (Wallaby Grass), Cynodon dactylon (Couch Grass), Calotis Iappulaccea (Yellow Burr-daisy), Dichondra repens (Kidney Weed), Desmodium varians (Variable Tick-trefoil) and Einadia nutans (Climbing Saltbush).

This community is concentrated in the conveyor/services corridor envelope portion of the modification areas and is present as scattered occurrences in the central-eastern portion of the Mount Pleasant Project area (**Figure 3.1**). Areas where *Eucalyptus albens x moluccana* (White Box/Grey Box intergrades) dominate grades quickly into grassy woodlands dominated by *Eucalyptus moluccana x albens* (Grey Box/White Box intergrades).



Photograph 3.1 Upper Hunter White Box–Ironbark Grassy Woodland

3.2.2 Grey Box/White Box Intergrade Grassy Woodland

Status: Endangered Ecological Community (TSC Act)

This variant is similar to Upper Hunter White Box–Ironbark Grassy Woodland except for the lack of *Eucalyptus albens* x *moluccana* (White Box/Grey Box intergrades) and minor



concentrations of *Eucalyptus crebra* (Narrow-leaved Ironbark). The associated other trees, shrubs and ground covers are similar to that described above for the Upper Hunter White Box–Ironbark Grassy Woodland and, the Grey Box/White Box Intergrade Grassy Woodland community corresponds to the description of Box-Gum Grassy Woodland under the TSC Act scientific determinations (NSW Scientific Committee, 2004a).

This community occurs in scattered occurrences across the modification areas (**Figure 3.1**).



Photograph 3.2 Grey Box/White Box intergrade open woodland within the Mount Pleasant Project area

3.2.3 Grey Box/ White Box Intergrade–Spotted Gum Grassy Woodland

Status: Endangered Ecological Community (TSC Act)

This community is similar in structure and make-up to that described above apart from the regular occurrence of *Corymbia maculata* (Spotted Gum) and the observation that *Corymbia maculata* (Spotted Gum) tends to be associated with *Eucalyptus moluccana* x *albens* (Grey Box/White Box intergrade) rather than *Eucalyptus crebra* (Narrow-leaved Ironbark).

The understorey layers generally contain the shrub species Notelaea microcarpa var. microcarpa, Acacia decora (Western Golden Wattle), Cassinia arcuata (Sifton Bush),



Breynia oblongifolia (Coffee Bush) and Dodonaea viscosa (Hop Bush). Typical forbs and grasses include Goodenia paniculata (Branched Goodenia), G. ovata (Hop Goodenia), Ozothamnus diosmifolium (White Dogwood), Brunoniella australis, Glycine tabacina (Variable Glycine), Wahlenbergia stricta (Austral Bluebell), Calotis cuneifolia (Purple Burrdaisy), Dianella longifolia (syn. D. laevis), Sida corrugata, Swainsona galegifolia (Smooth Darling Pea), Bothriochloa macra, Aristida ramosa (Three-awned Wiregrass), Chloris truncata (Windmill Grass), Lomandra filiformis (Wattle Mat-rush), Themeda australis (Kangaroo Grass) and Dichelachne micrantha (Shorthair Plumegrass).

Peake recorded a variant of his Upper Hunter Grey Box/White Box intergrade Grassy Woodland community that contained Spotted Gum and considered that more sampling was required to determine whether this represented a community in its own right (Peake, 2006). Analysis of this community within the Mount Pleasant Project area indicates that this community variant corresponds to the description of State (NSW Scientific Committee, 2004a) as the under-storey consists of species that are indicative of the community.

This community is restricted to the northwest of the modification areas in the infrastructure envelope (**Figure 3.1**).



Photograph 3.3

Grey Box/White Box Intergrade-Spotted Gum open woodland within the Mount Pleasant Project area

3.2.4 Derived Native Grassland

Status: Endangered Ecological Community (TSC Act)

Derived grassland (also known as secondary grassland or understorey) is an expression of the ecological community that develops when the tree canopy cover of the grassy woodland is removed or suffers dieback, and natural regeneration is prevented. The understorey of derived grassland remains relatively intact. Much of the grassland in the modification areas and adjacent land has historically been derived from the clearing of trees and shrubs to create pasture for livestock long before mining commenced. As such, the floristic composition of this community can vary according to the forest or woodland community from which it originated as well as being influenced by slope, aspect, soil and underlying geology.

The derived grassland identified within the modification areas, whilst predominantly native in composition, is a degraded community that has been affected to varying degrees across its extent by past clearing and grazing practices. Broadly, the original native understorey would have been dominated by palatable grasses such as *Themeda australis* (Kangaroo Grass) and various species of the genus *Austrodanthonia*. (Wallaby Grass), with a high frequency of herbaceous plants. Most areas of native derived grassland are now dominated by less palatable grasses including *Aristida* spp. and *Austrostipa* spp., with very minor proportions of Kangaroo Grass and Wallaby Grasses and a lower frequency of herbs present.

Within the modification areas this community conforms to the TSC Act listing for Box-Gum Grassy Woodland and native Derived Grassland (NSW Scientific Committee, 2004a). These are areas of native grassland characterised by an assemblage of understorey species that is representative of the understorey that typifies Box-Gum Grassy Woodland, namely Upper Hunter White Box–Ironbark Grassy Woodland. These areas of grassland are derived from the clearing of canopy trees of these communities.

Based upon the cumulative results of several seasons of survey, a high proportion of the Derived Grassland within the modification areas appears to be derived from areas historically dominated by the *Eucalyptus moluccana* x *albens* intergrades (Grey Box/White Box intergrades), which is defined as a dominant of the State Box-Gum Grassy Woodland.

This community occurs throughout the modification areas (Figure 3.1).



Photograph 3.4 Derived Native Grassland formed from the clearing of Upper Hunter White Box Intergrade-Ironbark Grassy Woodland. This grassland type predominates across the Mount Pleasant modification areas.

3.3 Other Forests, Woodland and Grasslands

3.3.1 Central Hunter Ironbark - Spotted Gum Forest

Status: Endangered Ecological Community (TSC Act)

Central Hunter Ironbark – Spotted Gum – Forest is an open forest/woodland community that is dominated by *Eucalyptus crebra* and *Corymbia maculata*. The community conforms to the TSC Act listed EEC Central Hunter Ironbark - Spotted Gum – Grey Box Forest (NSW Scientific Committee, 2009) but does not conform to the Commonwealth or State listed EECs due to the obvious lack of *Eucalyptus albens* (NSW Scientific Committee, 2004a, Threatened Species Scientific Committee, 2006).

The understorey assemblage is generally in conformity with surrounding woodland/forest communities although the shrub layer where present is dominated by *Acacia paradoxa* (Kangaroo Apple) and *Notelaea microcarpa* (Native Olive). The understorey is dominated by *Austrostipa verticillata* (Slender Bamboo Grass), *Aristida ramosa* (Three-awned Wiregrass), and *Bothriochloa decipiens*. Forb diversity is moderately high and includes



like Dichondra repens (Kidney Weed), Chrysocephalum apiculatum, Glycine tabacina (Variable Glycine) and Sida corrugata.

As with many other areas of woodland and forest in the Mount Pleasant Project area, shrub diversity is low and the shrub stratum is absent in many places. However, this occurrences of this community more recently been released from grazing allowing the regeneration of a shrub layer.

This community occupies a small isolated pocket in the northeast portion of the conveyor/service corridor envelope (**Figure 3.1**).



Photograph 3.5 Ironbark – Spotted Gum Forest in the modification areas

3.3.2 Narrabeen Footslopes Slaty Box Woodland

Status: Endangered Ecological Community (TSC Act)

Narrabeen Footslopes Slaty Gum Woodland typically occupies hot, dry locations in the Central Hunter and its distribution is strongly influenced by underlying geology (Peake 2006). This open woodland is dominated by the tree species *Eucalyptus dawsonii* (Slaty Box) and, *Allocasuarina luehmannii* (Buloak). The shrub layer is generally absent but where present is dominated by *Maireana microphylla* (Small-leaf Bluebush) and the exotic *Lycium ferocissimum* (African Boxthorn).

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The groundcover within this community is generally sparse with relatively low species richness. The level of exotics depend upon location with dominant species such as *Cynodon dactylon* (Couch Grass), *Pennisetum clandestinum* (Kikuyu), *Sida rhombifolia* (Paddys Lucerne), *Polygonum aviculare* (Wire Weed), *Modiola caroliniana* and *Galenia pubescens* (Galenia) dominating in exotic areas. Where natives dominate variable proportions of *Sporobolus creber* (Rats Tail Grass), *Chloris ventricosa* (Windmill Grass), *Bothriochloa macra* (Red Leg Grass) and *Aristida* spp. are present.

This community occurs within in one small isolated area within the southeast corner of the conveyor/service corridor envelope (**Figure 3.1**).

3.3.3 Hunter Floodplain Red Gum Woodland Complex

Status: Endangered Ecological Community (TSC Act)

The community exists as occasional scattered occurrences of *Eucalyptus tereticornis* (Forest Red Gum) and more commonly *Angophora floribunda* (Rough-barked Apple). *Casuarina cunninghamiana* (River Oak) and shrub species that generally typify this community are not present in this area, having been cleared for agriculture and subjected to ongoing grazing and weed invasion. A small portion of this community is dominated by *Eucaluptus melliodora* (Yellow Box). The understory component of this community is similar to the previously grazed understory species as described for the communities above. The understorey is dominated by native spear grasses (i.e. *Austrostipa verticillata* (Slender Bamboo Grass) and *Austrostipa scabra* ssp. *scabra*). An assemblage of native forbs are present but in low frequencies. Where Yellow Box occurs, this community has been too highly modified to correspond to the EPBC Act listed EEC Box-Gum grassy woodland. The derived grassland form of this community occurs at the edges of the woodland vegetation.

Hunter Floodplain Red Gum Woodland Complex occurs within the conveyor/services corridor envelope in an ephemeral creek network that is most likely inundated with water following heavy rain events (**Figure 3.1**).

3.3.4 Upper Hunter Hills Exposed Ironbark Woodland

Status: Not listed.

This is an open forest community that often occurs on drier north-facing slopes receiving high solar radiation and is characterised by the ubiquitous presence of *Eucalyptus crebra* (Narrow-leaved Ironbark). Other canopy species that can occur in low numbers include *Eucalyptus moluccana* x *albens* (Grey Box/White Box intergrades), *Angophora floribunda* (Rough-barked Apple) and *Brachychition populneus* ssp. *Populneus* (Kurrajong).

The understorey strata varies depending upon location from sparse and lacking a shrub layer to a complex ground cover with several shrub species. The shrub species where present include *Allocasuarina leuhmannii* (Buloak) *Maireana microphylla* (Small-leaf



Bluebush), Bursaria spinosa (Blackthorn), *Acacia paradoxa* (Kangaroo Apple) and *Notelaea microcarpa* (Native Olive). The ground layer is dominated by grasses such as *Aristida jerichoensis* (Jericho Grass), *Austrostipa verticilliata* (Slender Bamboo-grass) and to a lesser extent *Cymbopogon refractus* (Barbed-wire Grass) as well as *Bothriocloa decipiens*. Common forbs include *Dichondra repens (Kidney Weed), Chrysocephalum apiculatum., Glycine tabacina* (Variable Glycine) and *Einadia trigonos*. The derived grassland form of this community occurs at the edges of the woodland vegetation.

This community occurs within the central portion of the conveyor/services corridor envelope and the northeast corner of the infrastructure envelope (**Figure 3.1**).



Photograph 3.6 Upper Hunter Hills Exposed Ironbark Woodland in the Mount Pleasant Project area

3.3.5 Spotted Gum Forest

Spotted Gum Forest occurs in the infrastructure envelope (**Figure 3.1**) as a linear stand of *Corymbia maculata* over grassy understorey. It fringes a larger patch of vegetation dominated by *Eucalyptus crebra*. This patch of forest occurs near the southern boundary and is proximate to a homestead, farm sheds and a cattle feeding paddock. Much of the vegetation near these buildings shows signs of moderate to heavy disturbance including erosion, trampling and grazing by cattle, soil disturbance by pigs, and weed invasion.

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The shrub layer is very sparse and is typically comprised of hardy species like *Maireana microphylla* and *Solanum* spp. Signs of invasion from *Lycium ferrocissimum* are evident. The ground storey is dominated by *Austrostipa verticillata*, which is a native grass species that typically dominate in areas of pasture unimproved grassland impacted by years of grazing. Other grazing resistant native forbs present include a number of *Einadia* spp. and *Lepidium pseudohyssopifolium*. A low diversity of other herb species is present (e.g. *Calotis lappulacea, Vittadinia cuneata, Glycine tabacina*); however these species occur in low frequencies and with patchy distributions. The understorey appears to be consistent across the entire area of this community.

3.3.6 Low Diversity Derived Native Grassland and Exotic Pasture

Status: Not listed.

Some portions of the modification areas are comprised of derived native grasslands of low diversity. The low diversity is attributable to more intensive agricultural usage. Many of the native grasses and herbs that occur in the aforementioned derived native grasslands occur, but at much lower abundance and diversity. However, native herbs are in low abundance, particularly grazing sensitive native herbs.

Hardy native grasses such as grasses like *Aristida* spp. and *Austrostipa* spp. predominate in these areas and the more palatable native grasses like *Themeda australis* (Kangaroo Grass) and *Cymbopogon refractus* (Barbed Wire Grass) are largely absent. The low growing cosmopolitan grass *Cynodon dactylon* (Couch Grass) is often abundant in this grassland community, particularly where there has been heavy grazing by livestock. It commonly occurs with *Sida rhombifolia* (Paddys Lucerne) and *Medicago* spp (Medics).

On the old Hunter River floodplain landscapes, where soils have been ploughed for cultivation, almost no native ground cover vegetation remains. On such areas the main species comprise exotic pasture grasses and weeds.

This community occurs as scattered patches throughout the modification areas and is widespread in the east of Mount Pleasant Project area (**Figure 3.1**).





Photograph 3.7 Low Diversity Derived Native Grassland & Exotic Pasture

3.3.7 Tree and Shrub Plantations

Status: Not listed.

Along some of the margins of the infrastructure envelope and conveyor/services corridor envelope, tree and shrub plantations have been created as a screen to future mining operations (see **Figure 3.1**). These plantations consist of a variety of local native tree and shrub species including many from the Box-Gum Grassy Woodland community. The plantations are relatively young in age and generally consist of trees and shrubs less than 15 years of age. Some of the plantations have been created over derived native grassland and now provide habitat for a range of woodland fauna, including birds, bats and reptiles. Some of the threatened birds that are known to occur on the Mount Pleasant Project area, including Speckled Warbler and Grey-crowned Babbler, are likely to make use of such plantation areas as they can occur in relatively young woody vegetation surrounded by grassland.





Photograph 3.8 Tree plantings within the Mount Pleasant Project area

3.4 Flora

3.4.1 Introduction

Several flora surveys have been conducted within various portions of the Mount Pleasant Project area over a number of years. A total flora species list from all surveys conducted across the Mount Pleasant Project area is provided in **Appendix A**. This appendix includes species not previously identified in the modification areas but are considered to have high potential to occur. More than 300 flora species have been recorded within the Mount Pleasant Project area; with over 75 per cent of the species being native. The vegetation within the modification areas is consistent with the floristics of the vegetation in the remainder of the Mount Pleasant Project area.

3.4.2 Database Review

Database searches of listed threatened flora species were undertaken over an area 10km from an approximate centre of the Mount Pleasant Project area to take into account the transient nature of fauna and to capture records from similar habitats. The results of the search are tabulated in **Table 3.3** with an assessment of their likelihood of occurrence of

the species within the modification areas. Some additional species were also discussed if recorded from within the Muswellbrook LGA and if habitat assessment indicated that there was potential for these species to occur.

Family	Scientific Name	Common Name	TSC Act Status	EPBC Act Status	Habitat Requirements	Presence of Suitable Habitat and Likelihood of Occurrence
Fabaceae (Mimosoideae)	<i>Acacia pendula</i> population in the Hunter catchment	Weeping Myall population in the Hunter Catchment	E2	-	Typically occurs on heavy soils, sometimes on the margins of small floodplains, but also in more undulating locations.	Possible . Not recorded during extensive surveys of Mount Pleasant project area. Suitable habitat within the modification areas and Mount Pleasant Project area.
Myrtaceae	<i>Eucalyptus</i> <i>camaldulensis</i> population in the Hunter catchment	River Red Gum population in the Hunter catchment	E2	-	Forms stands of woodland and open woodland on the major floodplains of the Hunter and Goulburn rivers, especially in areas where water impoundment occurs after flood. May occur with <i>Eucalyptus tereticornis, Eucalyptus melliodora;</i> <i>Casuarina cunninghamiana</i> subsp. <i>cunninghamiana</i> and <i>Angophora floribunda</i> .	Possible but unlikely due to specific habitat requirements. Not recorded within the Mount Pleasant project area but know occurrences in adjacent areas. Sub- optimal habitat within the modification areas and Mount Pleasant Project area. Potential to occur in low lying wet areas.
Orchidaceae	Cymbidium	N/A	E2	-	Grows in the hollows of trees in dry sclerophyll forest or	Present. At least four
	canaliculatum				woodland; north from the Hunter Valley, chiefly in inland	specimens have been
	population in the				districts, west to New Angledool.	recorded within the Mount

Family	Scientific Name	Common Name	TSC Act Status	EPBC Act Status	Habitat Requirements	Presence of Suitable Habitat and Likelihood of Occurrence
	Hunter Catchment					Pleasant Project area but no known occurrences within the modification areas. Suitable habitat within the modification areas.
	Diuris tricolour	Pine Donkey Orchid	V	V	Found in sclerophyll vegetation on flats or small rises, on a range of substrates including sandy or loamy soils derived from granite, porphyry, laterite or alluvium.	Possible. Not recorded during any surveys of Mount Pleasant project area. Known to occur within nearby Mount Arthur Coal Offset areas. Suitable habitat within the modification areas and Mount Pleasant Project areas.
	Digitaria porrecta	Finger Panic Grass	E1	E	Native grassland, woodlands or open forest with a grassy understorey, on richer soils. Often found along roadsides and travelling stock routes where there is light grazing and occasional fire.	Possible . Not recorded during any surveys of Mount Pleasant project area. Suitable habitat within the modification areas and Mount Pleasant Project areas.

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Family	Scientific Name	Common Name	TSC Act Status	EPBC Act Status	Habitat Requirements	Presence of Suitable Habitat and Likelihood of Occurrence
Rhamnaceae	Pomaderris reperta	Denman Pomaderris	E1	-	Very restricted area of occupation. Prefers woodland in association with <i>Eucalyptus crebra, Eucalyptus blakelyi, Notelaea microcarpa</i> , and <i>Allocasuarina littoralis</i> . Associated soil is a sandy loam on sandstone or conglomerate.	Unlikely . Suitable habitat within the modification areas and Mount Pleasant Project areas. Unlikely to occur due to restricted range.
Santalaceae	Thesium australe	Austral Toadflax, Toadflax	V	V	Occurs in grassland or grassy woodland. Often found in damp sites in association with Kangaroo Grass (Themeda australis).	Possible . Not recorded during any surveys of the Mount Pleasant Project area. Suitable habitat within the modification areas and Mount Pleasant Project area.
Key to conserva	tion status			Key to Like	elihood	

Key to conservation status	Key to Likelihood
E = Endangered species under the and EPBC Act	Present – Observed during surveys
E1 = Endangered species under the TSC Act	Likely – Suitable habitat; found within the locality
E2 = Endangered population under the TSC Act	Possible – Suitable habitat; not recorded within the locality/region
V = Vulnerable species under the TSC and EPBC Acts	OR – Sub-optimal habitat; may use infrequently
	Unlikely – no suitable habitat present; no known records in the locality

3.4.3 Threatened Species

Based on **Table 3.2**, no TSC Act listed threatened flora species have been found within the proposed modification areas however one species is considered likely to occur and these are further discussed below. The EPBC Act listed Vulnerable species *Bothriocloa biloba* (Lobed-blue Grass) has been recorded in numerous locations adjacent to and within the modification area but will be discussed in no further detail here as the species was delisted from the TSC Act due to its relatively high abundance across the State (NSW Scientific Committee, 2004b).

i. Species likely to occur within the modification areas

a. Tiger Orchid, (Cymbidium canaliculatum)

While not recorded with the modification area this species is considered to have a high potential to occur. Four individuals of the epiphytic Tiger Orchid, (*Cymbidium canaliculatum*) have been recorded within the Mount Pleasant Project area while recent surveys of lands adjacent to the Mount Pleasant Project area identified an additional three occurrences of this species. *Cymbidium canaliculatum* forms part of an Endangered Population in the Hunter Catchment as listed under the TSC Act.



Photograph 3.9

Tiger Orchid located on the trunk of a Grey Box/White Box Intergrade within the Mount Pleasant Project area

3.5 Fauna

The primary fauna habitats located within the modification areas include:

- Woodland communities (such as Upper Hunter White Box-Ironbark Grassy Woodland);
- > Derived native grassland; and,
- > Permanent and ephemeral water bodies such as dams and creeks.

Key habitat features recorded during the survey periods include:

- Ephemeral riparian environments suitable for fauna species dependant on these habitats (e.g. amphibians);
- Ground cover, leaf litter, fallen timber and rocky outcrops suitable as shelter for small terrestrial fauna species;
- Tree hollows suitable as shelter and breeding habitat for a range of hollowdependant fauna;
- Blossom-producing trees suitable as foraging habitat for a range of nectarivores; and
- > Primary and secondary Koala feed tree species.

Features such as bush rock, fallen logs, leaf litter and ground vegetation, which provide shelter for many of the small to medium sized terrestrial fauna species known from the wider locality, were generally limited within the modification areas but can be found to some degree in most of the woodland communities within the modification areas. Generally, the types of terrestrial native species using the modification areas are likely to be restricted to those that are common and well-adapted to disturbed woodland and agricultural areas.

Introduced (feral) fauna species are prevalent throughout the Mount Pleasant Project area, and this trend is likely to continue throughout the modification areas. Signs of foxes, cats and dogs were observed; and all are a threat to native fauna through predation. Rabbits and introduced mice and rats are abundant throughout the Mount Pleasant Project area.

The mature living trees and stags that remain in forest and woodland communities within the modification areas provide a number of small to medium-sized tree hollows for fauna species dependant on this resource as shelter and breeding habitat. However large hollows in tall trees that provide breeding and shelter habitat, particularly for large forest owls and large gliders, are relatively scarce. The scarcity of these larger hollows can be attributed to the regenerating nature of the vegetation following past agricultural uses throughout the area.



All open forest and woodland vegetation communities within the modification areas would provide suitable foraging habitat for a wide range of nectarivorous birds during blossom periods. *Eucalyptus moluccana x albens* (Grey Box/White Box intergrade) were in heavy bud and mistletoe plants (*Amyema sp.*) were in heavy flower during the early months of 2010. It is likely that a number of nectar-dependant bird species would be attracted to the modification areas during the blossoming periods of dominant trees.

Feed trees for the Koala occur throughout the modification areas. The most widespread feed tree for the Koala within the modification areas is *Eucalyptus moluccana x albens* (Grey Box/White Box intergrade).

3.5.1 Database Review

Database searches of listed threatened fauna species were undertaken over an area 10km from an approximate centre of the disturbance area to take into account the transient nature of fauna and to capture records from similar habitats. The results of the search are tabulated in **Table 3.4** with an assessment of their likelihood of occurrence within the modification areas. Some additional species were also discussed if recorded from within the Muswellbrook LGA and where the habitat assessment indicated that there was potential for these species to occur.

Family	Scientific Name	Common Name	TSC Act Status	EPBC Act Status	Habitat Requirements	Presence of Suitable Habitat and Likelihood of Occurrence
Amphibians						
Hylidae	Litoria booroolongensis	Booroolong Frog	E	E	Live along permanent streams with some fringing vegetation cover such as ferns, sedges or grasses.	Unlikely . No suitable habitat within the modification areas.
Aves						
Accipitridae	Circus assimilis	Spotted Harrier	V	-	Occurs throughout the Australian mainland, except in densely forested or wooded habitats of the coast, escarpment and ranges. It is found most commonly in native grassland, but also occurs in agricultural land, foraging over open habitats including edges of inland wetlands.	Possible. Not recorded during any Mount Pleasant surveys. Suitable foraging habitat throughout the modification areas and Project area.
	Hieraaetus morphnoides	Little Eagle	V	-	Lives within open eucalypt forest, woodland or open woodland. Sheoak or acacia woodlands and riparian woodlands	Possible. Not recorded during any Mount Pleasant surveys. Suitable foraging habitat throughout the modification areas and Mount Pleasant Project area.
	Lophoictinia isura	Square-tailed Kite	V	-	Found in a variety of timbered habitats including dry woodlands and open forests. Shows a particular preference for	Possible . Not recorded during any Mount

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Family	Scientific Name	Common Name	TSC Act Status	EPBC Act Status	Habitat Requirements	Presence of Suitable Habitat and Likelihood of Occurrence
					timbered watercourses.	Pleasant surveys. Suitable foraging habitat throughout the modification areas and Mount Pleasant Project area.
Cacatuidae	Callocephalon fimbriatum	Gang-gang Cockatoo	V	-	In summer, generally found in tall mountain forests and woodlands, particularly in heavily timbered and mature wet sclerophyll forests. In winter, may occur at lower altitudes in drier more open eucalypt forests and woodlands, and often found in urban areas. Move to lower altitudes in winter, preferring more open eucalypt forests and woodlands, particularly in box-ironbark assemblages, or in dry forest in coastal areas. Favours old growth attributes for nesting and roosting.	Possible . Not recorded during any Mount Pleasant surveys. Suitable foraging habitat throughout the modification areas and Mount Pleasant Project area.
	Calyptorhynchus lathami	Glossy Black- Cockatoo	V	-	Forages on mostly she-oaks but also eucalypts, native cypress and brigalow in forests, woodlands and timbered watercourses, nesting in large hollows, high off the ground	Unlikely . No suitable habitat within the modification areas.
Ciconiidae	Ephippiorhynchus asiaticus	Black-necked Stork	E	-	Inhabits permanent freshwater wetlands including margins of billabongs, swamps, shallow floodwaters, and adjacent grasslands and savannah woodlands; can also be found occasionally on inter-tidal shorelines, mangrove margins and	Unlikely . No suitable habitat within the modification areas.

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Family	Scientific Name	Common Name	TSC Act Status	EPBC Act Status	Habitat Requirements	Presence of Suitable Habitat and Likelihood of Occurrence
Climacteridae	Climacteris picumnus	Brown Treecreeper	V	-	estuaries. Dry forest, woodlands and scrubs, paddocks, stumps and margins of denser wooded areas	Likely . Recorded within the Mount Pleasant Project area. Likely to occur throughout all woodland areas within the modification areas and Mount Pleasant Project area.
Estrildidae	Stagonopleura guttata	Diamond Firetail	V	-	Found in grassy eucalypt woodlands, including Box-Gum Grassy Woodlands and Snow Gum <i>Eucalyptus pauciflora</i> Woodlands. Also occurs in open forest, mallee, Natural Temperate Grassland, and in secondary grassland derived from other communities.	Likely. Recorded within the Mount Pleasant Project area. Likely to occur throughout all woodland areas within the modification areas and Mount Pleasant Project area.
Meliphagidae	Grantiella picta	Painted Honeyeater	V	-	Inhabits Boree, Brigalow and Box-Gum Grassy Woodlands and Box-Ironbark Forests. A specialist feeder on the fruits of mistletoes growing on woodland eucalypts and acacias	Possible . Not recorded during any Mount Pleasant surveys. Suitable foraging habitat throughout the

Family	Scientific Name	Common Name	TSC Act Status	EPBC Act Status	Habitat Requirements	Presence of Suitable Habitat and Likelihood of Occurrence
						modification areas and Mount Pleasant Project area.
	Melithreptus gularis gularis	Black- chinned Honeyeater	V	-	Occupies mostly upper levels of drier open forests or woodlands dominated by box and ironbark eucalypts. Feeding territories are large making the species locally nomadic.	Present. Recorded during recent surveys of the modification areas. Likely to forage infrequently across the modification areas during canopy blossom periods.
	Xanthomyza phrygia	Regent Honeyeater	E	Е	Inhabits dry open forest and woodland, particularly Box- Ironbark woodland, and riparian forests of River Sheoak	Possible. Not recorded during any Mount Pleasant surveys. Suitable foraging habitat throughout the modification areas and Mount Pleasant Project area.
Neosittidae	Daphoenositta chrysoptera	Varied Sittella	-	-	Inhabits eucalypt forests and woodlands, especially rough- barked species and mature smooth-barked gums with dead branches, mallee and <i>Acacia</i> woodland.	Likely . Recorded within the Mount Pleasant Project area. Likely to occur throughout all

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Family	Scientific Name	Common Name	TSC Act Status	EPBC Act Status	Habitat Requirements	Presence of Suitable Habitat and Likelihood of Occurrence
						woodland areas within the modification areas and Mount Pleasant Project area.
Pardalotidae	Pyrrholaemus saggitatus	Speckled Warbler	V	-	Inhabits a range of Eucalyptus dominated communities that have a grassy understorey, often on rocky ridges or gullies. Typical habitat would include scattered native tussock grasses, a sparse shrub layer, some eucalypt regrowth and an open canopy. Large, relatively undisturbed remnants are required for the species to persist in an area.	Present. Recorded during recent surveys of the modification areas. Likely to occur within all wooded areas within the modification areas.
Petroicidae	Melanodryas cucullata cucullata	Hooded Robin	V	-	Prefers lightly wooded country, usually open eucalypt woodland, acacia scrub and mallee, often in or near clearings or open areas. Requires structurally diverse habitats featuring mature eucalypts, saplings, some small shrubs and a ground layer of moderately tall native grasses.	Likely. Not recorded during any Mount Pleasant surveys. Suitable foraging habitat throughout the modification areas and Mount Pleasant Project area.
	Petroica boodang	Scarlet Robin	V	-	Lives in dry eucalypt forests and woodlands. The understorey is usually open and grassy with few scattered shrubs. This species lives in both mature and regrowth vegetation. It occasionally occurs in mallee or wet forest communities, or in	Likely . Not recorded during any Mount Pleasant surveys. Suitable foraging habitat

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Family	Scientific Name	Common Name	TSC Act Status	EPBC Act Status	Habitat Requirements	Presence of Suitable Habitat and Likelihood of Occurrence
					wetlands and tea-tree swamps. Scarlet Robin habitat usually contains abundant logs and fallen timber: these are important components of its habitat. In autumn and winter many Scarlet Robins live in open grassy woodlands, and grasslands or grazed paddocks with scattered trees	throughout the modification areas and Mount Pleasant Project area.
Pomatostomidae	Pomatostomus temporalis temporalis	Grey- crowned Babbler	V	-	Inhabits open Box-Gum Grassy Woodlands on the slopes, and Box-Cypress-pine and open Box Woodlands on alluvial plains	Present. Recorded during recent surveys of modification areas. Likely to occur throughout all woodland areas within the modification areas and Mount Pleasant Project area.
Psittacidae	Glossopsitta pusilla	Little Lorikeet	V	-	Mostly occur in dry, open eucalypt forests and woodlands. Gregarious, usually foraging in small flocks, often with other species of lorikeet. They feed primarily on nectar and pollen in the tree canopy, particularly on profusely-flowering eucalypts, but also on a variety of other species including Melaleuca and mistletoes. Nest hollows typically occur in living, smooth- barked eucalypts.	Likely. Not recorded during any Mount Pleasant surveys. Suitable foraging habitat throughout the modification areas and Mount Pleasant Project area.

Family	Scientific Name	Common Name	TSC Act Status	EPBC Act Status	Habitat Requirements	Presence of Suitable Habitat and Likelihood of Occurrence
	Lathamus discolor	Swift Parrot	E	Ε	Migrates irregularly to the locality in the winter to forage on winter-flowering tree species such as Swamp Mahogany and Spotted Gum	Possible. Not recorded during any Mount Pleasant surveys. Suitable foraging habitat throughout the modification areas and Mount Pleasant Project area.
	Neophema pulchella	Turquoise Parrot	V	-	Lives on the edges of eucalypt woodland adjoining clearings, timbered ridges and creeks in farmland	Possible. Not recorded during any Mount Pleasant surveys. Suitable foraging habitat throughout the modification areas and Mount Pleasant Project area.
Rostratulidae	Rostratula australis	Australian Painted Snipe	V	E	Prefers fringes of swamps, dams and nearby marshy areas where there is a cover of grasses, lignum, low scrub or open timber	Unlikely . No suitable habitat within the modification areas.
Strigidae	Ninox connivens	Barking Owl	V	-	Inhabits eucalypt woodland, open forest, swamp woodlands and, especially in inland areas, timber along watercourses. Denser vegetation is used occasionally for roosting. During	Possible . Not recorded during any Mount Pleasant surveys.

Family	Scientific Name	Common Name	TSC Act Status	EPBC Act Status	Habitat Requirements	Presence of Suitable Habitat and Likelihood of Occurrence
					the day they roost along creek lines, usually in tall understorey trees with dense foliage such as <i>Acacia</i> and <i>Casuarina</i> species, or the dense clumps of canopy leaves in large <i>Eucalypts</i>	Suitable foraging habitat throughout the modification areas and Mount Pleasant Project area.
	Ninox strenua	Powerful Owl	V	-	Inhabits a range of vegetation types, from woodland and open sclerophyll forest to tall open wet forest and rainforest.	Possible. Not recorded during any Mount Pleasant surveys. Suitable foraging habitat throughout the modification areas and Mount Pleasant Project area.
Tytonidae	Tyto novaehollandiae	Masked Owl	V	-	Forests, open woodlands, farmlands with large trees, timbered watercourses, paperbark woodlands, caves; nest in hollow eucalypts, bare sand or earth of caves	Possible. Not recorded during any Mount Pleasant surveys. Suitable foraging habitat throughout the modification areas and Mount Pleasant Project area.

Family	Scientific Name	Common Name	TSC Act Status	EPBC Act Status	Habitat Requirements	Presence of Suitable Habitat and Likelihood of Occurrence
Mammals						
Dasyuridae	Dasyurus maculatus	Spotted- tailed Quoll	V	E	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	Likely. Not recorded during any Mount Pleasant surveys but several recent records in the vicinity of the project area. Suitable foraging habitat throughout the modification areas and Mount Pleasant Project area.
Emballonuridae	Saccolaimus flaviventris	Yellow- bellied Sheathtail- bat	V	-	Roosts in tree hollows and buildings; in treeless areas they are known to utilise mammal burrows.	Likely. Possible record using Anabat detection within Mount Pleasant Project area in recent surveys. Suitable foraging habitat throughout the modification areas and Mount Pleasant Project area.
Molossidae	Mormopterus	Eastern	V	-	Occurs in dry sclerophyll forest and woodland east of the	Likely. Recorded within

Family	Scientific Name	Common Name	TSC Act Status	EPBC Act Status	Habitat Requirements	Presence of Suitable Habitat and Likelihood of Occurrence
	norfolkensis	Freetail-bat			Great Dividing Range. Roost mainly in tree hollows but will also roost under bark or in man-made structures	Mount Pleasant Project area. Likely to occur throughout all woodland areas within the modification areas and Mount Pleasant Project area.
Petauridae	Petaurus australis	Yellow- bellied Glider	V	-	Occur in tall mature eucalypt forest generally in areas with high rainfall and nutrient rich soils	Unlikely . No suitable habitat within the modification areas.
	Petaurus norfolcensis	Squirrel Glider	V	-	Inhabits mature or old growth Box, Box-Ironbark woodlands and River Red Gum forest west of the Great Dividing Range and Blackbutt-Bloodwood forest with heath understorey in coastal areas. Prefers mixed species stands with a shrub or Acacia mid-storey.	Likely. Recorded within Mount Pleasant Project area. Suitable habitat throughout all woodland areas within the modification areas and Mount Pleasant Project area.
Pteropodidae	Pteropus poliocephalus	Grey-headed Flying-fox	V	V	Rainforest, mangroves, paperbark swamps, wet/dry sclerophyll forests	Likely . Recorded adjacent to Mount Pleasant Project area. Suitable habitat

Family	Scientific Name	Common Name	TSC Act Status	EPBC Act Status	Habitat Requirements	Presence of Suitable Habitat and Likelihood of Occurrence
Phascolarctidae	Phascolarctos cinereus	Koala	V	-	Inhabit eucalypt woodlands and forests. Feed on the foliage of more than 70 eucalypt species and 30 non-eucalypt species, but in any one area will select preferred browse species.	throughout all woodland areas within the modification areas and Mount Pleasant Project area. Possible . Not recorded during any Mount Pleasant surveys. Suitable foraging habitat throughout the modification areas and Mount Pleasant Project area.
Vespertilionidae	Chalinolobus dwyeri	Large-eared Pied Bat	V	V	Found in well-timbered areas containing gullies. Roosts in caves, crevices in cliffs and old mine workings frequenting low to mid-elevation dry open forest and woodland close to these features	Possible . Not recorded during any Mount Pleasant surveys. Suitable foraging habitat throughout the modification areas and Mount Pleasant Project area.
	Falsistrellus	Eastern	V	-	Preters moist habitats, with trees taller than 20 m. Generally	Likely. Possible record

Family	Scientific Name	Common Name	TSC Act Status	EPBC Act Status	Habitat Requirements	Presence of Suitable Habitat and Likelihood of Occurrence
	tasmaniensis	False Pipistrelle			roosts in eucalypt hollows, but has also been found under loose bark on trees or in buildings	using Anabat detection within study areas in recent surveys. Suitable foraging habitat throughout the modification areas and Mount Pleasant Project area.
	Miniopterus australis	Little Bent- wing Bat	V	-	Prefer well timbered areas including rainforest, wet and dry sclerophyll forest, <i>Melaleuca</i> swamps and coastal forests. Roosting in caves and eat insects	Possible. Not recorded during any Mount Pleasant surveys. Suitable foraging habitat throughout the modification areas and Mount Pleasant Project area.
	Miniopterus schreibersii oceanensis	Eastern Bent- wing Bat	V	-	Prefers forested valleys but also found in rainforests, wet/dry schlerophyll forests, monsoon forests, open woodlands, paperbark forests & open grasslands. Roosting in caves or tunnels.	Likely. Not recorded within modification areas but known to occur within Mount Pleasant Project area. Likely to occur throughout all woodland areas within the

Family	Scientific Name	Common Name	TSC Act Status	EPBC Act Status	Habitat Requirements	Presence of Suitable Habitat and Likelihood of Occurrence
						modification areas and Mount Pleasant Project area.
	Myotis adversus	Large-footed Myotis	V	-	Most habitats near water, including mangroves, paperbark swamps, riverine monsoon forest, rainforest, wet and dry sclerophyll forest, open woodland and River red gum woodland	Likely. Recorded within mount Pleasant Project area. Likely to occur in areas adjacent to wetland and waterway areas within the modification areas and Mount Pleasant Project area.
	Nyctophilus timoriensis	Eastern Long-eared Bat	V	V	Inhabits a variety of vegetation types, including mallee, bulloke Allocasuarina leuhmanni and box eucalypt dominated communities, but it is distinctly more common in box/ironbark/cypress-pine vegetation that occurs in a north- south belt along the western slopes and plains of NSW and southern Queensland	Possible. Not recorded during any Mount Pleasant surveys. Suitable foraging habitat throughout the modification areas and Mount Pleasant Project area.
	Scoteanax	Greater	V	-	Cool temperate to tropical moist forests, woodland and	Likely. Possible record
	rueppeilli	DIVAQ-NOSEQ			rainiorest. Freier moist guilles within mature coastal forest or	using Anapat detection

Family	Scientific Name	Common Name	TSC Act Status	EPBC Act Status	Habitat Requirements	Presence of Suitable Habitat and Likelihood of Occurrence
		Bat			rainforest. May roost in tree hollows and feed along forest edges or streams.	within mount Pleasant Project area. Suitable foraging habitat throughout the modification areas and Mount Pleasant Project area.
	Vespadelus troughtoni	Eastern Cave Bat	V	-	A cave-roosting species that is usually found in dry open forest and woodland, near cliffs or rocky overhangs; has been recorded roosting in disused mine workings	Possible. Not recorded during any Mount Pleasant surveys. Suitable foraging habitat throughout the modification areas and Project area.
Key to co	onservation status			<u> </u>	Key to Likelihood	
CE = Crit	ically endangered speci	es under the TSC A	ct	Present – (Dbserved during surveys	
E = Enda	ngered species under th	ne TSC Act		Likely – Su	itable habitat; found within the locality	
V = Vulne	erable species under the	TSC Act		Possible –	Suitable habitat; not recorded within the locality/region	
				OR –	- Sub-optimal habitat; may use infrequently	
				L	Inlikely – no suitable habitat present; no known records in the locality	

3.5.2 Threatened species

A small number of TSC Act listed threatened species have been recorded within the proposed modification areas, while other species known to occur within the area are considered highly likely to utilise the habitat within the modification areas. These species are discussed in more detail below.

i. Threatened species known to occur

a. Speckled Warbler

The Speckled Warbler was recorded at three locations within the modification area between during the February 2010 surveys. The species lives in a wide range of *Eucalyptus* dominated communities that have a grassy understorey, often on rocky ridges or in gullies with fallen timber. This species prefers relatively large undisturbed remnants of woodland and hence much of the Project area is considered unsuitable for this species confining it to woodland remnants. It is however expected to occur throughout all of the wooded modification areas.

b. Grey-crowned Babbler

A family of Grey-crowned Babblers was recorded at one location within the modification areas during the 2010 surveys. The species inhabits open Box-Gum Grassy Woodlands, Box-Cypress-pine and open Box Woodlands on alluvial plains (NSW Scientific Committee, 2001b). It is likely that there is more than one family group of this species present within the modification areas, however the highly altered nature of the vegetation within the modification areas renders much of the habitat unsuitable for this species due to lack of understorey and ground structure. It is however expected to occur throughout the wooded modification areas.

c. Black-chinned Honeyeater

A small group (approximately six to eight) of this species was recorded from within the proposed conveyor/services corridor envelope feeding on flowering mistletoe during February 2010 surveys. The species occupies a number of forest and woodland habitats, but requires large areas of intact habitat with nectar-producing trees (NSW Scientific Committee, 2001a). Given the large home-range required for this species, it is likely that Black-chinned Honeyeaters forage across the wooded areas of the proposed modification areas on occasions during blossoming periods of dominant canopy and mistletoe species.

ii. Threatened species considered likely to occur

a. Woodland Birds

The following birds are listed as Vulnerable under the TSC Act and are considered likely to occur within the modification areas despite not being recorded in recent surveys. It is

considered likely that all of these species would occur throughout all of the more heavily wooded locations within the modification areas at least occasionally.

- Brown Treecreeper (Climacteris picumnus);
- > Varied Sittella (Daphoenositta chrysoptera);
- > Diamond Firetail (Stagonopleura guttata);
- Hooded Robin (Melanodryas cucullata);
- > Little Lorikeet (*Glossopsitta pusilla*) and
- Scarlet Robin (*Petroica boodang*).

iii. Mammals

No threatened mammals have been known to occur within the modification areas however some species are considered likely to occur. It is considered likely that all of the species, listed below, at some stage, would occur throughout all of the more heavily wooded locations within the modification areas.

Potential roosting and breeding habitat is restricted to forest and woodland areas for some of the microchiropteran bats, it is possible for these species to forage across all grasslands within the modification areas.

a. Spotted-tailed Quoll (*Dasyurus maculatus*)

The Spotted-tailed Quoll (*Dasyurus maculatus*) is listed as Vulnerable under the TSC Act. Several records exist for this species within the Muswellbrook LGA including records close to the Mount Pleasant Project area in 2004 (DECC (NSW), 2007). The species creates dens in hollow-bearing trees, fallen logs, small caves, rock crevices, boulder fields or rocky-cliff faces and males of the species are known to have extensive home ranges up to 3500 ha. The species was not found during surveys of the Project area and no den sites were located during the habitat assessments. However, due to the proximity of records in the locality, it is considered possible that the species could forage occasionally in the modification areas.

b. Squirrel Glider (Petaurus norfolcensis)

A pair of Squirrel Gliders (*Petaurus norfolcensis*) was observed feeding in *Corymbia maculata* (Spotted Gum) within the Mount Pleasant Project area during 2009 surveys (**Figure 3.2**). It is considered likely that the species could forage throughout the modification areas also. The Squirrel Glider is listed as Vulnerable under the TSC Act.

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



A single Grey-headed Flying-fox (*Pteropus poliocephalus*) was recorded flying in a north westerly direction adjacent to the Mount Pleasant Project area during 2009 surveys and is likely to occur intermittently throughout the modification areas. It is most likely that this individual is a member of the Grey-headed Flying-fox colony located within Burdekin Park, Singleton. While no other Grey-headed Flying-fox individuals have been recorded within the Mount Pleasant Project area it is considered likely that the species could forage throughout the modification areas. The species is listed as Vulnerable under the EPBC and TSC Acts.

d. Microchiropteran Bats

Several microchiropteran bat species, listed below, were recorded from within the Mount Pleasant Project area through various survey methods. All of these species are considered likely to at least forage within the modification areas.

- Eastern Bentwing-bat (*Miniopterus schreibersii oceanensis*) (Vulnerable under the TSC Act).
- > Eastern Free-tail Bat (*Mormopterus norfolkensis*) (Vulnerable under the TSC Act);
- > Large-footed Myotis (*Myotis macropus*) (Vulnerable under the TSC Act);
- Yellow-bellied Sheath-tailed Bat (Saccolaimus flaviventris) (Vulnerable under the TSC Act);
- Greater Broad-nosed Bat (Scoteanax rueppellii) (Vulnerable under the TSC Act); and
- Eastern False Pipistrelle (*Falsistrellus tasmaniensis*) (Vulnerable under the TSC Act).

3.5.3 General Fauna Species

A range of habitat is available across the modification areas for amphibians, reptiles, birds and mammals. A full list of fauna species recorded across the Mount Pleasant Project in all surveys from 1994 area is provided in **Appendix B**. This appendix includes species not previously identified in the modification areas but are considered to have high potential to occur.

i. Amphibians

Little amphibian habitat occurs in the modification areas and no threatened species have been found within them. Some intermittent drainage lines within the modification areas would create temporary pools following heavy rain and provide suitable foraging and breeding habitat for a different suite of amphibian species. Habitat assessments of the
modification areas indicated that they would not provide suitable habitat for any State listed threatened amphibian species.

ii. Reptiles

The long grazing history within the modification areas is likely to have led to a decreased abundance of reptiles. A number of common species are likely to occur within the modification areas as these areas provide some suitable woodland habitat for reptiles known to occupy this locality. No threatened reptile species have been recorded within the Mount Pleasant Project area or modification areas.

iii. Birds

Habitat assessments and previous surveys indicate that the modification areas provide suitable foraging, shelter and breeding habitat for a range of common bird species as well as to threatened species listed under the TSC Act. The modification areas provide abundant habitat for woodland and grassland-dependant species, as well as limited habitat for species dependant on open forest communities.

The modification areas support a number of small dams and ephemeral water courses, some of the dams supporting aquatic vegetation. However, habitat assessment of the modification areas indicate that they do not provide suitable habitat for the majority of bird species dependent on wetland habitat and only common, adaptable wetland birds were recorded during surveys.

The habitat assessments and surveys also indicate that the modification areas provide suitable foraging habitat for a range of common diurnal raptors and potential foraging habitat for some threatened species. However, the large nest trees within riparian habitats required by some species for nesting were largely absent from within the modification areas. The modification areas also provide suitable foraging habitat for a range of forest and woodland-dependant owls. The absence of large hollow-bearing trees and dense riparian vegetation is likely to limit the suitability of nesting and roosting habitat within the Project area for these species.

Three birds that are listed as Vulnerable under the TSC Act have been recorded within the modification areas and four more are known to occur within the Mount Pleasant Project area. These additional four species are considered likely to occur within the modification areas. Further details on these threatened species are outlined in **Section 3.5.3** below.

iv. Mammals

a. Terrestrial Mammals

Habitat assessment indicates that the modification areas have undergone clearing in the past and therefore much of the open forest and woodland vegetation that now occurs



within these areas is regrowth, although some scattered old-growth trees have been retained. As a result, the complexity of habitat structure required by some terrestrial mammals has been removed however, some of the remaining mature trees and stags provide small to medium sized hollows suitable as shelter habitat for small arboreal mammals.

Terrestrial mammal fauna within the modification areas has continually been reported as containing a high proportion of exotic pest species, with the vast majority of small terrestrial mammals sighted and trapped across all surveys being exotic. Such a pattern is expected to be continuous throughout the modification areas.

The native terrestrial fauna is dominated by macropod species. The species recorded are generally more resilient to disturbance and are able to traverse larger areas of cleared land to migrate back into regenerating communities such as those within the modification areas.

b. Arboreal Mammals

Only three arboreal mammals have been recorded within the Mount Pleasant Project area. These were, the Common Brushtail Possum (*Trichosurus vulpecula*), Sugar Glider (*Petaurus breviceps*) and Squirrel Glider (*Petaurus norfolkensis*). The Squirrel Glider is listed as a vulnerable species under the TSC Act. It is expected that all three of these species would be found in the modification areas.

v. Bats

A number of microbat species are known to occur in the locality of the Mount Pleasant Project area; including some that are threatened under the TSC Act. To date none of these species have been recorded within the modification areas but many are considered likely to occur. Although each of these bat species has specific habitat requirements for roosting and breeding, many are able to utilise a variety of forest, woodland and grassland communities as foraging habitat. A total of 12 microbat species were positively identified within the Project area, with a further two or three species with calls that were not able to be positively identified from ultrasonic call analysis. At least six threatened microbat species have been positively identified from the surveys conducted within the Mount Pleasant Project area with potential for an additional threatened species depending on ambiguities in call analysis. All of these species are listed as Vulnerable under the TSC Act and all have potential to occur within the modification areas.

Habitat assessments indicated that a number of hollow-bearing dead and living trees within the modification areas would provide suitable roosting and breeding habitat for non cave-dependant species. These threatened species are discussed in more detail below.

A single Grey-headed Flying-fox was recorded adjacent to the Mount Pleasant Project area during 2009 surveys. This species feeds on blossoming canopy and mid-story trees

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and has potential to forage within all trees within the modification areas, during blossoming periods. This species is listed as vulnerable under the TSC Act.



Conveyor/Services Corridor Envelope

Vegetation Communities

Infrastructure Envelope

Modification Areas

Grassland (Hunter Floodplain Red Gum Woodland Complex) Grassland (Upper Hunter Hills Exposed Ironbark Woodland)

Derived Native Grassland

Low Diversity Derived Native Grassland

Tree and Shrub Plantations

2000 m

1500

1000

500

200





Impact Assessment

4.1 Introduction

This chapter discusses the potential impacts of the proposed modifications to State protected ecological communities and threatened flora and fauna species.

The assessment provides the comparative areas and types of vegetation communities to be cleared by the approved rail facilities and specific locations of infrastructure within the infrastructure area (as detailed in the EIS) versus the proposed modification components assuming worst case alignment of the conveyor/service corridor and configuration of infrastructure within the infrastructure envelope (refer to **Figure 1.2**). These are termed 'approved disturbance' and 'proposed disturbance' respectively. Approved for the purposes of this report relates to Development Consent DA 92/97.

The potential impacts of the proposed modifications on vegetation communities have been discussed under direct and indirect impacts. Direct impacts are caused as a primary result of clearing. Indirect impacts are a result of secondary processes and often occur around the periphery of a development. They include such things as weed invasion, increases in feral animals, erosion, and changes in habitat connectivity.

4.2 Vegetation Communities

4.2.1 Direct Impacts

The primary impact from the proposed modifications will be the clearing of vegetation. 'Clearing of Native Vegetation' is listed as a Key Threatening Process and has been identified as a direct cause of the decrease in biodiversity (NSW Scientific Committee, 2004a). However, it should be noted that the proposed modifications relate to options of already approved infrastructure and may lead to reductions in clearing.

A conservative worst case approach to the ecological impact assessment has been adopted in which it has been assumed that:

the maximum areas of highest quality native vegetation will be cleared within the infrastructure and conveyor/service corridor envelopes; and a 30m disturbance area has been included along the entire length of the conveyor/service corridor.

As a result a worst case development scenario for the modification areas that maximises impact upon woodland firstly followed by grasslands. The conveyor/services corridor as opposed to the rail facility proposed in the previous project, will result in a reduction of impact area of approximately 7.3ha. A comparison of the approved disturbance to the proposed disturbance within the modification areas can be seen in **Table 4.1** below while the worst case scenario identified for the infrastructure and conveyor/services corridor can be seen in **Figure 4.1**.

Table 4.1COMPARISON OF DISTURBANCE FOOTPRINTS OF THE APPROVED
AND PROPOSED PROJECTS

Modification Area	Approved disturbance (ha)	Proposed disturbance (ha)
Infrastructure Area	31.2	~31.2
Rail Facilities and		
Conveyor/Service Corridor	23.6	~16.3
Total	54.8	47.5

The proposed modifications are seeking approval to locate the Project infrastructure and the conveyor/service corridor (if this option is pursued) within envelopes identified in **Figure 1.2**. As described above, in an attempt to quantify impacts on vegetation a worst case scenario has been developed. However, in reality the clearing of forest and woodland vegetation within these envelopes will be avoided or reduced, where possible, through detailed design.

Avoidance of listed EECs and important fauna/flora habitats, where possible, will be considered high in the hierarchy of parameters to be considered in locating this infrastructure; other constraints to location of infrastructure considered will include logistical, topographic and location of residences. These avoidance measures may enable a reduction in the worst case potential impacts on these EECs and fauna habitat.

Table 4.2 shows the comparative areas and types of vegetation communities to be disturbed by the approved rail facilities and specific locations of infrastructure within the infrastructure area (as detailed in the EIS), versus the proposed modification components assuming worst case alignment of the conveyor/service corridor and configuration of infrastructure within the infrastructure envelope (refer to **Figure 4.1**).

Under the worst case scenario, the total modification area footprint would entail approximately 47.5ha of vegetation clearance, versus approximately 54.8ha of clearance for the approved project resulting in a reduced impact if approximately 7.3ha in comparison to the approved project. Accordingly, it is not considered necessary to provide as a compensatory offset measure to ameliorate these impacts.

Vegetation Community	Approved Disturbance (ha) [Infrastructure and Rail Facility]	Modified Disturbance (ha) [Infrastructure and Conveyor]
Upper Hunter White Box-Ironbark Grassy Woodland	-	1.3
Grey Box/White Box Intergrade – Spotted Gum Grassy Woodland	-	-
Grey Box/White Box Intergrade Grassy Woodland	2.0	9.1
Central Hunter Ironbark - Spotted Gum - Grey Box Forest	-	0.9
Hunter Floodplain Red Gum Woodland Complex	0.2	0.2
Tree and Shrub Plantations	1.1	0.8
Upper Hunter Hills Exposed Ironbark Woodland	1.6	4.2
Derived Native Grassland (Box-Gum)	39.6	24.0
Grassland (Hunter Floodplain Red Gum Woodland Complex)	0.5	0.6
Grassland (Upper Hunter Hills Exposed Ironbark Woodland)	1.4	1.3
Low Diversity Derived Native Grassland and Exotic Pasture	8.4	5.1
Total	54.8	47.5

.Table 4.2 VEGETATION COMMUNITIES POTENTIALLY IMPACTED BY APPROVED AND PROPOSED DISTURBANCE

4.2.2 Indirect Impacts

As with the currently approved infrastructure, clearing associated with the proposed modifications would lead to an increased impact from edge effects on adjacent areas of vegetation. Edge effects can have an adverse affect upon the habitat of the retained communities by reducing the quality and integrity of the community. The edges of the retained vegetation may be impacted by micro-climate changes (e.g. increased sunlight, air temperature and soil temperature) resulting in changes in species composition and increased weed invasion. Other edge effects resulting from habitat fragmentation can include increased susceptibility to infection, such as infection of native plants by the fungus *Phytophthora cinnamoni*.

The modification of abiotic factors necessary for vegetation survival (such as surface water drainage patterns and nutrient loads) through the construction of 'hard-stand' areas, could also impact the retained vegetation communities. Changes to drainage lines can affect the integrity, structure and composition of surrounding habitat and thus, have secondary impacts on the vegetation communities that rely on them.

The clearing of vegetation may lead to the fragmentation of the communities within the modification areas. Fragmentation of the vegetation community will reduce patch size and



potentially increase the edge to area ratio. Any increase to this ratio would result in an increased potential of edge effects occurring. The fragmentation of communities within the Project area also has the potential to impact ecological communities on both a local and regional scale. Fragmentation of a community can result in the isolation of vegetation patches both locally and regionally. Isolation of patches can decrease the amount of genetic exchange between remaining patches of vegetation by severing the small-scale potential genetic transfer mechanisms such as seed dispersal by ants and reproductive root suckering.

4.3 Flora

4.3.1 General

The proposed modifications relate to options of already approved infrastructure and may lead to reductions in clearing by approximately 7.3ha. The retained vegetation adjacent to the proposed modification areas may also be indirectly impacted due to:

- Increased runoff, erosion and sedimentation;
- Hydrological changes (e.g. increased/decreased storm water runoff from the roads and mining infrastructure);
- > Weed invasion; and
- Long and short-term edge effects resulting from the clearing of vegetation (e.g. changes in light filtration).

The impact of clearing on the threatened flora species that have been recorded or have potential to occur within the modification areas is outlined in **Section 4.3.2** below.

4.3.2 Threatened Plant Species

The threatened flora species known or considered to have the potential to occur within the modification areas are similar to those within the approved disturbance area. Given there will be a reduction in clearing (if the conveyor/service corridor option is pursued), the potential for impacts on threatened flora species is likely to be less. Appropriate mitigation measures will be implemented as a result of the proposed modifications in an attempt to minimise impacts upon these species.



4.4 Fauna

4.4.1 Fauna Habitat

The proposed modifications (provided the conveyor/service corridor option is pursued) would result in a reduction of clearing of similar habitats that occur within the approved disturbance. Considering this, potential impact on fauna habitat is likely to be less. Mitigation measures are proposed such as pre-clearance surveys and re-establishment of vegetation following impacts (refer **Chapter 5** below). Clearing associated with the proposed conveyor/services corridor will be limited to a width of 30m which is not considered to be a significant barrier to the movement of fauna species and therefore the conveyor is considered unlikely to result in a significant impact upon fauna movement patterns or cause fragmentation and genetic isolation of fauna populations.

4.4.2 Threatened Fauna Species

Numerous threatened species have been recorded or are considered likely to occur within the modification areas as described in **Chapter 3**. The vegetation within the proposed modification areas is not considered to constitute habitat critical to the survival of any of the species. The proposed conveyor/services corridor will be a maximum of 30m wide and will require the clearing of approximately 16ha of forest woodland and grassland compared with approximately 23ha under the approved project. While this habitat may be utilised by many of the threatened species listed above, the removal of a 30m corridor of vegetation is not considered to constitute a significant impact as the highly mobile nature of these species will allow them to be able to continue to forage and breed in the area. A maximum width of clearing of the 30m conveyor/service corridor is not considered extensive enough to cause population and/or genetic isolation as a result of fragmentation even for species such as the squirrel glider.

Measures to mitigate the potential impacts on threatened fauna species are described in **Chapter 5** below.

4.4.3 Koala Habitat

The proposed modification areas will potentially require the clearing of Koala habitat. The area contains known primary *Eucalyptus tereticornis* (Forest Red Gum) secondary feed trees *Eucalyptus moluccana* x *albens* (Grey Box/White Box intergrades), although the primary feed tree species has not been recorded within the conveyor/services corridor. Although compared to the approved project, the proposed modifications would result in the clearing of 25.5ha of potential habitat, due to the presence of these secondary feed trees an assessment is required under State Environmental Planning Policy No. 44 – Koala Habitat Protection (SEPP 44) and the approved Recovery Plan (DECC (NSW), 2008b).

The SEPP 44 has been prepared to assist in the conservation of the Koala. The aim of SEPP 44 is to encourage the proper conservation and management of areas of natural



vegetation that provide habitat for Koalas. Schedule 1 lists the LGAs which are covered by SEPP 44, and Schedule 2 lists the feed tree species for the Koala. The Mount Pleasant Project falls within Muswellbrook LGA which is listed under Schedule 1 and schedule 2 lists *Eucalyptus albens* (White Box) as a primary feed tree. An approved Recovery Plan for the Koala has been prepared by (then) DECC (2008b). Within this plan, management areas have been delineated across NSW.

Assessments of potential impacts on Koala habitat have been made according to each of these documents below.

i. Approved Recovery Plan for the Koala (DECC (NSW) 2008b)

Koalas occur in the Muswellbrook LGA but have not been recorded within the modification areas. The approved Koala Recovery Plan (DECC (NSW), 2008b) divides NSW into a series of Koala Management Areas and the Upper Hunter Valley has forest and woodland that is intermediate between two of these areas, the Central Coast and the Northern Tablelands.

The Koala Recovery Plan mentions a suite of trees that are primary and secondary feed trees for Koalas in each management area. The proposed modification areas contain forest and woodland vegetation that includes *Eucalyptus moluccana* x *albens* (Grey Box/White Box intergrades). Both of these species are listed as secondary feed trees in the recovery plan.

The Recovery Plan provides two systems to categorise Koala habitat, which are both based upon the abundance of primary and secondary feed tree species:

- Option 1: Within the first category system the proposed conveyor/services corridor is considered Secondary Habitat (Class B) as the primary food tree species absent and secondary feed species are present. According to this category, the proposed conveyor/services corridor is capable of supporting a viable, low density population of Koalas.
- Option 2: Within the second category system, the proposed conveyor/services corridor is considered Secondary Habitat (Class C) as primary food tree species are absent and secondary feed species comprise less than 30% of the overstorey trees. According to this classification, the proposed conveyor/services corridor is considered capable of supporting a low-density Koala population.

ii. State Environmental Planning Policy No. 44 – Koala Habitat Protection

The intent of SEPP 44 is to foster conservation and management of areas of natural vegetation that provide habitat for the Koala to ensure permanent free-living populations over their present range and to reverse the current trend of population decline.



The proposed modification areas is subject to assessment under SEPP 44 because the land occurs in a LGA listed in Schedule 1 of the policy. All development applications that are in a SEPP 44 LGA and impacting areas one hectare or greater, including adjoining lands on the same holding, are required to be assessed under SEPP 44.

Assessment under SEPP 44 is based on an initial determination of whether the land constitutes potential Koala habitat. This is determined by assessing whether the eucalypt species present in Schedule 2 constitute 15% or more of the total number of trees in the upper or lower strata of the tree component. If potential Koala habitat is present, the area must be further assessed to determine if the land is core Koala habitat. The species listed in Schedule 2 present within the proposed conveyor/services corridor envelope is *Eucalyptus albens* (White Box). While the majority of suitable feed trees within the optional conveyor/services corridor are *Eucalyptus moluccana x albens* (Grey Box/White Box intergrades) it is considered appropriate that the area be regarded as potential Koala habitat.

Given that potential Koala habitat occurs in the optional conveyor/services corridor envelope; the policy requires that it must be determined whether the area forms core Koala habitat under the definition of SEPP 44. Core Koala habitat is defined under this legislation as

"an area of land with a resident population of Koalas, evidenced by attributes such as breeding females (that is, females with young) and recent sightings of and historical records of a population".

It is unlikely that a resident population of Koalas occurs within the proposed modification areas; as no evidence of Koala use was observed during extensive field surveys since prior to 1997. There are also no historical or anecdotal records of Koalas from within the Mount Pleasant Project area and only one koala record from within 10km of the Project area (DECCW, 2010). The modification areas are not considered to be core Koala habitat as defined under SEPP 44; hence the preparation of a Koala Plan of Management is not required. SEPP 44 therefore does not place any constraints on the proposed modifications.

4.5 Streams and Wetlands

While some small ephemeral streams, periodically damp areas and farm dams will be impacted as a result of the proposed modifications, there will be minimal increased impacts upon such habitats as a result of the proposed modifications. As a result it is considered that no additional mitigation or offsetting requirements on streams and wetlands are required.



4.6 Wildlife Corridors

The vegetation in and around the modification areas is highly fragmented and has been heavily impacted by past agricultural land use. As a result the vegetation currently in the locality consists of a mosaic of areas of regrowth with the occasional old growth tree and scattered trees throughout grazing lands. This pattern in the vegetation produces little to no wildlife corridors and distinct areas of regrowth vegetation which on the larger scale are largely isolated from other areas of vegetation. The proposed modifications are not likely to have a significant impact upon fauna movement on a local or regional scale.

On a local scale the proposed conveyor/services corridor (if pursued) would fragment the vegetation through the clearing of a 30m (maximum width) corridor through of the vegetation. This corridor is not considered to be large enough to impact on the flora and fauna species of the area to cause isolation of populations, reduction in fauna movements or the reduction in the transfer of flora propagules. Re-establishment of understory species will ensure the latter two processes continue following construction of the conveyor. Again, should the conveyor/service corridor option be pursued, the approved development footprint would reduce by approximately 7.3ha and this reduces the disturbance of vegetation communities and potential impacts to wildlife corridors.



Coordinate System: MGA Zone 56 (GDA 94)



Mitigation Measures

5.1 Introduction

The DECCW has prepared principles for the use of biodiversity offsets DECC (NSW) (2008a). Foremost among these is the principle that impacts must be avoided first by using prevention and mitigation measures. This principle means that the ecological impacts of proposed developments should be managed as follows:

- Avoid: to the extent possible, developments should be designed to avoid or minimise ecological impacts;
- Mitigate: where certain impacts are unavoidable through design changes, mitigation measures should be introduced to ameliorate the ecological impacts of the proposed development; and
- Compensate: the residual impacts of the project should be compensated for in some way to offset what would otherwise be a net loss of habitat.

This chapter explains the way these points have been applied to manage the potential impacts of the Project.

5.2 Avoidance Measures

Avoidance measures are difficult for mining projects such as coal mines because mineral resources occur in fixed locations. Notwithstanding this the design of the approved Project was examined to see if changes to the footprint could be made to avoid potential impacts. Should the conveyor/service corridor option be pursued, the approved development footprint would reduce by approximately 7ha and therefore reduces the disturbance of vegetation communities currently listed under the TSC Act.

While the finalised locations and hence impact areas of the of the proposed modifications are yet to be finalised, avoidance of EECs and important fauna/flora habitats, where possible, will be considered high in the hierarchy of parameters to be considered in locating this infrastructure; other constraints to location of infrastructure considered will be include logistical, topographic and location of residences. These avoidance measures

may enable a reduction in the worst case potential impacts on these EECs and fauna habitat.

5.3 Mitigation Measures

5.3.1 Revegetation

Revegetation of impacted areas will occur across the proposed modification areas where appropriate and will be implemented as soon as practically possible following impact. Revegetation will use locally sourced native plant species and where practical, topsoil will be translocated from impact areas to conserve the native seed bank of local ecological communities. This will:

- Maintain or re-establish connectivity following clearing and where the disturbance is no longer required;
- > Maintain the quality and diversity of native growth in revegetation areas;
- Maximise the establishment of a diversity of native species, particularly the understorey species that maintain the ecological function of native vegetation communities; and
- > Expediently replace habitat for native flora and fauna.

Details of the rehabilitation of the infrastructure area and conveyor/service corridor (should this option be pursued) upon decommissioning will be provided in the Rehabilitation and Environment Management Plan (REMP).

5.3.2 Pre-clearance and Translocation of Threatened Species and Important Habitat Attributes

Mitigation measures will include pre-clearance surveys of forest and woodland areas to be cleared to identify any threatened flora and fauna species or habitat within areas of impact. This process will be implemented for all clearing associated with the proposed modifications and provide an opportunity to avoid impacts to flora and fauna of conservation significance during clearing. Where it is practical, threatened species or important habitat attributes (such as sizeable logs and salvaged tree hollows) will be relocated to impacted areas to re-establish fauna habitat value within the impacted areas.

Any individuals of the threatened flora or fauna identified in areas to be cleared will be relocated to the nearest available suitable habitat, where relocation is considered appropriate.

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5.3.3 Monitoring and Management

Ecological management and monitoring will be in accordance with Rio Tinto Coal Australia's Health, Safety, Environment and Quality (HSEQ) Management System, which is certified to the international standard ISO:14001(2004). The HSEQ Management System includes an environmental policy, a series of regulatory required management plans, a monitoring programme and environmental standards and procedures. It will incorporate a Flora and Fauna Management Plan (FFMP) for the Mount Pleasant Project, inclusive of the modification areas, as required under Condition 3.4 of the development consent. Plans and procedures for land use, bushfire management, erosion and sediment control, biodiversity management, disturbance and rehabilitation, and ground disturbance will also be included.

During the construction phase, pre-clearance surveys of relevant forest and woodland areas to be removed will be undertaken, for threatened flora and fauna species. Where practical, threatened species or important habitat attributes (such as sizable logs and salvaged tree hollows) will be relocated.

An ongoing monitoring programme, as per Condition 8.6 of the development consent, will be implemented for the Mount Pleasant Project, inclusive of the modification areas. Results of the monitoring will be assessed against performance criteria and key performance indicators to determine if the management objectives are being met. The monitoring programme will be regularly reviewed to ensure it remains effective. Identified monitoring locations associated with the construction and operation of the proposed modifications, will be included in the AEMR as per Condition 8.6 of the development consent.

Details of the rehabilitation of the infrastructure area and conveyor/service corridor (should this option be pursued) upon decommissioning will be provided in the Rehabilitation and Environment Management Plan.

5.4 Compensatory Measures

The modified Mount Pleasant Project will have a lesser impact than the approved project by approximately 7.3ha. As a result it is not considered necessary to provide Biodiversity Management Areas as a compensatory measure to offset any impacts. Any flora or fauna requiring relocation following pre-clearance surveys will be placed in the nearest area of suitable habitat.

Mitigation Measures	General Ecological Benefits
Dust minimisation	Control of dust reduces the indirect impacts on vegetation condition and the habitat quality for all native species at Mount Pleasant.
Noise minimisation	Minimisation of noise benefits fauna by reducing the potential for disturbance of animals in habitat patches around the mine.
Weed control	Weed control helps to protect the integrity of native vegetation within the Mount Pleasant Project area and maintains or improves the quality of habitat for plant and animal species.
Feral animal control	Feral animal control helps to control foxes, rabbits and other feral animals that are key threats to many wildlife species.
Rehabilitation of disturbed areas	Rehabilitation of disturbed areas restores forest and woodland cover to disturbed areas and adds habitat for flora and fauna in the long term.
Linkage and integration of rehabilitation areas with existing vegetated areas to improve ecological function and provide habitat	Increases the viability of the scattered patches of habitat that occur across the lease area, connecting them and facilitating movement of native species between patches.
Creation of habitat corridors linking isolated remnant vegetation stands	Increases the viability of the scattered patches of habitat that occur across the lease area, connecting them and facilitating movement of native species between patches.

Table 5.1 SUMMARY OF PROPOSED ECOLOGICALLY RELEVANT MITIGATION MEASURES

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Table 5.1 SUMMARY OF PROPOSED ECOLOGICALLY RELEVANT MITIGATION MEASURES

Mitigation Measures	General Ecological Benefits
Management of surface water, erosion and sedimentation	Protects the integrity of the landscape.
Ongoing monitoring and maintenance of all revegetation works and habitat enhancement activities	Maintains the viability of the rehabilitated areas in the long term and provides feedback data that can be used for adaptive management.
Pre-clearance inspections and tree felling procedures	Provides an opportunity to avoid impacts to arboreal fauna during clearing and/or enables relocation of fauna to secure areas of vegetation.
Relocation of salvaged tree hollows and (where required) the establishment of nest boxes in adjacent vegetation communities.	Makes efficient use of tree hollows that could otherwise be destroyed. Replaces tree hollows that are to be lost from clearing operations by establishing nest boxes within secure habitat. This maintains the number of tree hollows on site in the short to medium term.
Ongoing monitoring of native flora and fauna across the Mount Pleasant Project area including the modification areas	Provides data for ongoing adaptive management of threatened and regionally significant flora and fauna.

Chapter 6

Conclusion

The landscape of the proposed modification areas has been used for grazing since European settlement and as a result has been heavily cleared and disturbed historically. Notwithstanding this, vegetation communities listed as EECs under the TSC Act are located within the modification areas, including but not limited to; Upper Hunter White Box - Ironbark Grassy Woodland, Grey Box/White Box Intergrade Grassy Woodland, Grey Box/White Box Intergrade Spotted Gum Grassy Woodland and Derived Native Grassland (from Box-Gum Grassy Woodland),

To provide for flexibility in the detailed design of the infrastructure area and optional conveyor/service corridor, a conservative worst case approach to ecological impact assessment was adopted. Under the worst case scenario, the total modification area footprint would comprise approximately 47.5ha of vegetation clearance, versus approximately 54.8ha of clearance for the approved rail facilities and infrastructure area. The proposed worst case scenario would result in total disturbance of approximately 35.5ha of vegetation communities currently listed under the TSC Act compared with approximately 41.6ha under the approved disturbance footprint.

The DECCW principles on management of potential ecological impacts have been considered with the proposed modifications providing options that may result in an approximate 7.3ha reduction in disturbance of vegetation communities, should the conveyor/service corridor option be pursued.

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FINAL REPORT COAL & ALLIED OPERATIONS PTY LIMITED 30 SEPTEMBER 2010 Appendix A

Flora Species List

MOUNT PLEASANT PROJECT MODIFICATION

Family	Species	2006 CE	2007 CE	2008 Envirofactor	2009 CE	2010 CE
Trees						
Anacardiaceae	Schinus molle*		х			
Arecaceae	Phoenix canariensis*		х			
Casuarinaceae	Allocasuarina luehmannii	х	x			
Loranthaceae	Amyema sp.	х				
	Dendrophthoe vitellina	х				
Myrtaceae	Corymbia maculata	х	х		х	x
	Eucalyptus albens x moluccana				х	
	Eucalyptus moluccana x albens	х	х		х	x
	Eucalyptus blakelyi	х	х			
	Eucalyptus crebra	х	х		х	x
	Eucalyptus melliodora		х			x
	Eucalyptus moluccana		х			
	Eucalyptus moluccana x albens	х	х		х	x
	Eucalyptus sp.		х		х	
	Eucalyptus tereticornis				х	
Rutaceae	Geijera salicifolia	х				
Sterculiaceae	Brachychiton populnea	x	x		x	x
Shrubs						
Apocynaceae	Gomphocarpus fruticosus*		x		x	x
Asteraceae	Cassinia arcuata	х	х			
	Cassinia cunninghamii	х				
	Cassinia quinquefaria				х	
	Xanthium spinosum*		х			x
Celastraceae	Maytenus silvestris		х			
Chenopodiaceae	Atriplex semibaccata		х	x		x
	Atriplex sp.		х			
	Atriplex suberecta			x		
	Chenopodium sp.		x			
	Maireana decalvans			x		
	Maireana enchylaenoides			x		
	Maireana microphylla	x	x		x	x
	Sclerolaena birchii	x			x	

Family	Species	2006 CE	2007 CE	2008 Envirofactor	2009 CE	2010 CE
	Sclerolaena divaricata			х		
	Sclerolaena sp.		x			
Euphorbiaceae	Phyllanthus virgatus	х	х		x	х
Fabaceae	Acacia leucoclada ssp leucoclada		х			
	Acacia paradoxa	х	х		х	х
	Acacia salicina		х			
	Acacia sp.	х			x	
	Indigofera australis	х	x			
	Zornia dyctiocarpa	х	x			
	Neptunia gracilis		х			х
Luzuriagaceae	Eustrephus latifolius		х			
Malvaceae	Abutilon oxycarpum		х			
Myoporaceae	Myoporum montanum		х			
Myrtaceae	Melaleuca armillaris		х			
	Melaleuca styphelioides		x			
Oleaceae	Notelaea microcarpa	х	х		x	х
	Notelaea microcarpa v. microcarpa					х
	Olea europea ssp africana*		x			
Pittosporaceae	Bursaria spinosa	х	х			х
Rubiaceae	Canthium odoratum		х			
Solanaceae	Lycium ferosissimum*	х	х		х	х
	Solanum americanum			х		
	Solanum brownii					х
	Solanum cinereum	х	х	х		х
	Solanum nigrum*		х		х	х
	Solanum opacum				x	
	Solanum sp.				х	
	Solanum stelligerum	х	х			
Stackhousiaceae	Stackhousia viminea	х	х		х	х
Thymelaeaceae	Pimelea curviflora	х	х		х	
	Pimelea curviflora var. sericea					x

Herbs - Ferns and

Family	Species	2006 CE	2007 CE	2008 Envirofactor	2009 CE	2010 CE
Adiantaceae	Cheilanthes distans		x			x
	Cheilanthes sieberi	х	x	х	x	x
Herbs - Dicots						
Acanthaceae	Brunoniella australis	x	x		x	x
	Rostellularia adscendens	x	x	x	x	x
Aizoaceae	Galenia pubescens*	x	x	x	x	x
Amaranthaceae	Alternanthera denticulata					x
	Alternanthera nana		х			
	Alternanthera nodiflora		х			
	Alternanthera pungens*		х			
	Gomphrena celosioides*					x
Apiaceae	Centella asiatica				x	
	Ciclospermum leptophyllum*		x			
	Conium maculatum		x			
	Daucus glochidiatus			x	х	
	Foeniculum vulgare	x				x
	Hydrocotyle laxiflora		x	x	x	
Asteraceae	Aster subulatus					x
	Asteraceae sp.		x		x	
	Bidens pilosa*		x		х	
	Bidens subalternans		x			
	Brachycome sp.		x			x
	Calotis cuneifolia				x	
	Calotis lappulacea	x	x	x	х	x
	Carthamus lanatus*	x	x	x	х	x
	Chrysocephalum apiculatum	x	x	x	х	x
	Chrysocephalum semipapposum				х	x
	Cirsium vulgare*		x		х	x
	Conyza bonariensis*			x		
	Conyza sp.*		x		x	x
	Cotula australis	x	x			
	Crassula sp.	x				
	Cymbonotus lawsonianus		x	x		

Family	Species	2006 CE	2007 CE	2008 Envirofactor	2009 CE	2010 CE
	Cymbopogon refractus	x	x	x	x	x
	Cynodon dactylon*		x	x	x	х
	Euchiton gymnocephalus			x		
	Euchiton sphaericus				x	
	Glossogyne tannensis	x	x		х	x
	Gnaphalium sp.				х	
	Gnaphalium sphaericum			x		
	Hypochaeris microcephala*		x			
	Hypochaeris radicata*		x		х	х
	Lactuca saligna*				х	
	Podolepis jaceoides					х
	Schkuhria pinnata var abrotanoides*		x			
	Senecio madagascariensis*	x	x	x	х	x
	Senecio quadridentatus				x	
	Silybum marianum		x			
	Solenogyne bellioides	x	x		x	
	Solenogyne bellioides/dominii		x			
	Soliva sp.*		x		x	
	Sonchus asper*				x	
	Sonchus oleraceus*	x	x		x	
	Tagetes minuta*					х
	Taraxacum officinale*		x		x	
	Vernonia cinerea		x		x	x
	Veronica plebiea	x	x		x	х
	Vittadina spp.	х	x		x	х
	Vittadinia cuneata		x	x	x	х
	Vittadinia cuneifolia	х	х			
	Vittadinia muelleri			x		
	Vittadinia pterochaeta			x		
Boraginaceae	Cynoglossum australe					х
	Heliotropium amplexicaule*		x			
Brassicaceae	Brassica sp.*		x			
	Lepidium bonariense*		x		x	
	Lepidium pseudohyssopifolium		x		x	x

Family	Species	2006 CE	2007 CE	2008 Envirofactor	2009 CE	2010 CE
	Lepidium sp.	x	х			
	Lepidium virginicum		х			
Campanulaceae	Wahlenbergia communis		х			
	Wahlenbergia gracilis		x		x	
	Wahlenbergia sp		x	x		
	Wahlenbergia stricta				х	
Caryophyllaceae	Cerastium glomeratum*		x			
	Paronychia brasiliana	x			х	
	Petrorhagia dubia				х	
	Petrorhagia nanteuilii	х				
	Polycarpon tetraphyllum	х			х	
	Spergularia rubra*		х	х		
	Stellaria media		х			
Chenopodiaceae	Chenopodium carinatum			х		
	Chenopodium glaucum		х			
	Chenopodium pumilio		х			
	Einadia hastata			x	х	х
	Einadia nutans	х	x	x	х	x
	Einadia nutans ssp linifolia		х	x		
	Einadia nutans/polygonoides		x		х	x
	Einadia polygonoides					х
	Einadia trigonos	х	x		х	x
	Enchylena tomentosa		х			x
	Salsola tragus			x		
Clusiaceae	Hypericum Gramineum				х	
	Hypericum Perforatum				х	
Convolvulaceae	Dichondra repens	х	х	x	х	x
Euphorbiaceae	Chamaesyce dallachyana			х		
	Chamaesyce drummondii	х	х		х	x
	Chamaesyce sp.		х			
Fabaceae	Desmodium varians	х	х		х	x
	Medicago polymorpha*				х	х
	Trifolium dubium*				х	
	Desmodium brachvpodum	x	x			х

Family	Species	2006 CE	2007 CE	2008 Envirofactor	2009 CE	2010 CE
	Medicago sativa*					x
	Medicago sp.*	x	x			
	Pultenaea sp.			x		
	Swainsona galegifolia				x	
	Trifolium repens*		x		x	
	Trifolium sp.*				x	
Gentianaceae	Centaurium erythraea				x	
	Centaurium sp.		x			
Geraniaceae	Erodium crinitum	x	х	x		
	Geranium solanderi			x	x	x
	Geranium sp.		x			
	Pelargonium australe					х
	Pelargonium sp.			x		
Goodeniaceae	Goodenia pinnatifida			x		
	Goodenia rotundifolia					х
Lamiaceae	Ajuga australis	x	x		x	
	Marrubium vulgare				x	
	Mentha satureioides		x	x	х	x
	Salvia verbenaca*	x	x			
Linaceae	Linum trigynum*				х	
Lobeliaceae	Pratia purpurascens				x	х
Malvaceae	Malva parviflora*		х			
	Modiola caroliniana*		х		х	х
	Sida corrugata	х	х	x	х	х
	Sida cunninghamii	х	х			х
	Sida filiformis					х
	Sida rhombifolia*	x	x	x	х	x
	Sida sp.					х
Myoporaceae	Eremophila debilis	x	x	x	х	x
Myrsinaceae	Anagallis arvensis*	х	х	x	х	х
Nyctaginaceae	Boerhavia dominii					х
Oxalidaceae	Oxalis corniculata		x			
	Oxalis exilis		x		x	
	Oxalis perennans		x	х	x	x

Family	Species	2006 CE	2007 CE	2008 Envirofactor	2009 CE	2010 CE
	Oxalis sp.	х	х		x	
Phyllanthaceae	Poranthera microphylla				x	x
Plantaginaceae	Plantago debilis	x	х		x	x
	Plantago gaudichaudii				x	
	Plantago lanceolata*	х	x		х	х
Polygonaceae	Polygonum aviculare*		х			
	Polygonum plebeium			x		
	Rumex brownii	х	x	x	х	х
Portulacaceae	Portulaca oleracea		x			x
Rosaceae	Acaena sp.		x			
	Rosa rubiginosa*		х			
Rubiaceae	Asperula conferta	х	x	x	х	х
	Psydrax odoratum				х	
	Richardia stellaris*	x	x			x
Scrophulariaceae	Verbascum virgatum*		x			
Urticaceae	Urtica dioica*				x	
Verbenaceae	Glandularia aristigera*			x		
	Verbena officinalis*				х	
	Verbena bonariensis					x
	Verbena bonariensis/rigida				x	
	Verbena rigida					x
	Verbena sp.*		х			x
	Verbena tenuisecta*		x			
Zygophyllaceae	Tribulus terrestris*					x
Viscaceae	Notothixos cornifolius		x			
Herbs - Monocots						
Anthericaceae	Arthropodium milleflorum				х	
	Arthropodium sp.	x	х			
	Dichopogon fimbriatus				x	
	Tricoryne simplex		х			
Asphodelaceae	Asphodelus fistulosus*				x	
	Bulbine sp.			x		
Cactaceae	Opuntia spp.*	х	x			

Family	Species	2006 CE	2007 CE	2008 Envirofactor	2009 CE	2010 CE
	Opuntia stricta*					x
Cyperaceae	Carex inversa		x	x	х	x
	Cyperus gracilis	х	x		x	x
	Cyperus sp.					x
	Fimbristylis dichotoma		x			x
	Scleria mackaviensis	х	х			
Hypoxidaceae	Hypoxis hygrometrica					х
Iridaceae	Romulea rosea*		х			
Juncaceae	Juncus subsecundus				х	
Lomandraceae	Lomandra filiformis			x		
	Lomandra filiformis ssp coriacea	х	х			
	Lomandra filiformis ssp filiformis				х	х
	Lomandra multiflora	х	х	x	х	х
	Lomandra sp.				х	
Orchidaceae	Cymbidium canaliculatum		х			
Phormiaceae	Dianella longifolia		х		х	
	Dianella revoluta					x
	Dianella sp.				х	
Poaceae	Aristida jerichoensis†				х	
	Aristida ramosa	х	х	x	х	x
	Aristida sp.		х			x
	Aristida vagans		х			
	Austrodanthonia bipartita			x		
	Austrodanthonia caespitosa					х
	Austrodanthonia fulva				х	
	Austrodanthonia racemosa	х	х		х	
	Austrodanthonia sp.	х				х
	Austrodanthonia tenuior		х			
	Austrostipa aristiglumis			x		
	Austrostipa scabra				х	х
	Austrostipa sp.				х	
	Austrostipa verticillata			x	х	х
	Axonopus fissifolius (syn. A. affinis)*				х	
	Bothriochloa biloba		х	х	х	

Family	Species	2006 CE	2007 CE	2008 Envirofactor	2009 CE	2010 CE
	Bothriochloa decipiens					x
	Bothriochloa decipiens/macra	x	x	х	x	
	Bothriochloa macra					х
	Bromus catharticus*				х	х
	Chloris acicularis		x			
	Chloris truncata		x	x	х	x
	Chloris ventricosa	x	х	x	x	x
	Danthonia linkii		х			
	Dichanthium sericeum		х	x	x	x
	Dichelachne micrantha		х			
	Dichelachne sp.				х	х
	Digitaria brownii		х	х		
	Digitaria divaricatissima		х	х		
	Digitaria sp.	х	х		х	
	Echinochloa crus-gali*					x
	Echinochloa sp.					х
	Ehrharta erecta	х				
	Eleusine tristachya*					х
	Elymus scaber	х	х		х	
	Enteropogon acicularis	х	х			
	Eragrostis leptostachya	х	х	х		x
	Eragrostis sp.		х			
	Eriochloa pseudoacrotricha		х	x		
	Eulalia aurea (syn. E. fulva)					х
	Lachnagrostis filiformis				х	x
	Microlaena stipoides	х	х		х	х
	Panicum effusum		х		х	х
	Panicum queenslandicum		х			
	Panicum sp.			х		
	Paspalidium aversum		х			
	Paspalidium distans				х	х
	Paspalidium gracile		х			
	Paspalidium sp.	х				
	Paspalum dilatatum*		х		х	х

Family	Species		2007 CE	2008 Envirofactor	2009 CE	2010 CE
	Paspalum sp.					х
	Pennisetum clandestinum		x			
	Pennisetum villosum		х			
	Poa sieberiana Poa sp. Poaceae spp.					x
					х	
						x
	Setaria parviflora (syn. S. gracilis)*					x
	Sorghum sp.					x
	Sporobolus creber	х	х	х	х	x
	Sporobolus sp.				х	x
	Stipa scabra	х	х			
	Stipa verticillata	х	х			
	Themeda australis				x	
Vines/Creepers						
Bignoniaceae	Pandorea pandorana		х			
Commelinaceae	Commelina cyanea		x			x
Convolvulaceae	Convolvulus erubescens		х	х	x	x
Fabaceae	Glycine clandestina			х	x	x
	Glycine microphylla		х			x
	Glycine sp.	х	х			
	Glycine tabacina	х	х		х	х
	Hardenbergia violacea				x	

*denotes exotic species

Appendix B

Fauna Species List

MOUNT PLEASANT PROJECT MODIFICATION

Family	Scientific Name	Common Name	TSC	EPBC	CE	CE	CE	CE
			Act Status	Act Status	1997	2006	2009	2010
Amphibians								
Hylidae	Litoria latopalmata	Broad-palmed Frog	Р				x	
Myobatrachidae	Crinia signifera	Common Eastern Froglet	Р			x		
	Limnodynastes tasmaniensis	Spotted Grass Frog	Р				х	
Aves								
Acanthizidae	Acanthiza chrysorrhoa	Yellow-rumped Thornbill	Р			x	x	х
	Acanthiza lineata	Striated Thornbill	Р			x		
	Acanthiza nana	Yellow Thornbill	Р			x	x	x
	Acanthiza reguloides	Buff-rumped Thornbill	Р			x	x	х
	Gerygone fusca	Western Gerygone	Р			x		
	Gerygone albogularis	White-throated Gerygone	Р				x	х
	Smicrornis brevirostris	Weebill	Р			x	x	х
Accipitridae	Accipiter fasciatus	Brown Goshawk	Р				x	
	Aquila audax	Wedge-tailed Eagle	Р		x	x	x	
	Elanus axillaris	Black-shouldered Kite	Р		x		x	
	Haliastur sphenurus	Whistling Kite	Р				x	

Family	Scientific Name	Common Name	TSC	EPBC	CE	CE	CE	CE
			Act Status	Act Status	1997	2006	2009	2010
			Otatus	Otatus				
Aegothelidae	Aegotheles cristatus	Australian Owlet-nightjar	Р				х	
Alcedinidae	Dacelo novaeguineae	Laughing Kookaburra	Р		х	х	x	
	Todiramphus sanctus	Sacred Kingfisher	Р			x	х	
Anatidae	Anas gracilis	Grey Teal	Р		x			
	Anas superciliosa	Pacific Black Duck	Р			x		
	Chenonetta jubata	Australian Wood Duck	Р		x	x	x	
	Egretta novaehollandiae	White-faced Heron	Р		x	x	x	
Artamidae	Artamus cyanopterus	Dusky Woodswallow	Р			х	x	
	Cracticus nigrogularis	Pied Butcherbird	Р		x	х	x	x
	Cracticus torquatus	Grey Butcherbird	Р			х	x	x
	Gymnorhina tibicen	Australian Magpie	Р		x	х	x	x
	Strepera graculina	Pied Currawong	Р				x	x
Cacatuidae	Cacatua galerita	Sulphur-crested Cockatoo	Р		x	х	x	x
	Eolophus roseicapillus	Galah	Р		x	х	x	x
	Nymphicus hollandicus	Cockatiel	Р				x	
Campephagidae	Coracina novaehollandiae	Black-faced Cuckoo-shrike	Р			х	x	x
	Coracina tenuirostris	Cicadabird	Р			х		
	Lalage sueurii	White-winged Triller	Р			х	x	
Charadriidae	Vanellus miles	Masked Lapwing	P			x	x	

MOUNT PLEASANT PROJECT MODIFICATION
Family	Scientific Name	Common Name	TSC	EPBC	CE	CE	CE	CE
			Act Status	Act Status	1997	2006	2009	2010
	Vanellus tricolor	Banded Lapwing	Р		х			
Climacteridae	Climacteris picumnus victoriae	Brown Treecreeper (eastern subspecies)	V				х	
	Cormobates leucophaea	White-throated Treecreeper	Р			x	х	x
Columbidae	Ocyphaps lophotes	Crested Pigeon	Р		x	x	х	х
	Phaps chalcoptera	Common Bronzewing	Р				х	
Coraciidae	Eurystomus orientalis	Dollarbird	Р			х	x	х
Corcoracidae	Corcorax melanorhamphos	White-winged Chough	Р		x	х	х	
Corvidae	Corvus coronoides	Australian Raven	Р		x	х	x	х
	Corvus mellori	Little Raven	Р				х	
	Cacomantis pallidus	Pallid Cuckoo	Р			х		х
	Cacomantis variolosus	Brush Cuckoo	Р					х
	Scythrops novaehollandiae	Channel-billed Cuckoo	Р			х		
Dicaeidae	Dicaeum hirundinaceum	Mistletoebird	Р			x	х	
	Grallina cyanoleuca	Magpie-lark	Р			х	x	х
	Myiagra inquieta	Restless Flycatcher	Р				х	
	Myiagra rubecula	Leaden Flycatcher	Р			х	x	
	Rhipidura albiscapa	Grey Fantail	Р		x	х	x	x
	Rhipidura leucophrys	Willie Wagtail	Р		х	x	х	x
	Neochmia temporalis	Red-browed Finch	Р			x		

Family	Scientific Name	Common Name	TSC	EPBC	CE	CE	CE	CE
			Act Status	Act Status	1997	2006	2009	2010
			otatao	otatao				
	Stagonopleura guttata	Diamond Firetail	V				х	
	Taeniopygia bichenovii	Double-barred Finch	Р			х	х	
Falconidae	Falco berigora	Brown Falcon	Р			х	х	
	Falco cenchroides	Nankeen Kestrel	Р		х	х	x	
	Falco longipennis	Australian Hobby	Р				x	
	Falco peregrinus	Peregrine Falcon	Р				x	
	Falco subniger	Black Falcon	Р				x	
Hirundinidae	Hirundo neoxena	Welcome Swallow	Р		х	х	x	
	Hirundo rustica	Barn Swallow	Р	Μ	x			
	Petrochelidon ariel	Fairy Martin	Р			х		
	Petrochelidon nigricans	Tree Martin	Р			х	x	
Maluridae	Malurus cyaneus	Superb Fairy-wren	Р		x	x	x	x
Meliphagidae	Entomyzon cyanotis	Blue-faced Honeyeater	Р			x		
	Lichenostomus penicillatus	White-plumed Honeyeater	Р				x	
	Manorina melanocephala	Noisy Miner	Р		х	х	x	х
	Melithreptus brevirostris	Brown-headed Honeyeater	Р			х	x	х
	Melithreptus gularis gularis	Black-chinned Honeyeater	V					х
	Philemon corniculatus	Noisy Friarbird	Р			х	х	х
Motacillidae	Anthus novaeseelandiae	Australasian Pipit	Р			х	х	

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Family	Scientific Name	Common Name	TSC	EPBC	CE	CE	CE	CE
			Act Status	Act Status	1997	2006	2009	2010
Neosittidae	Daphoenositta chrysoptera	Varied Sittella	V			х		
Oriolidae	Oriolus sagittatus	Olive-backed Oriole	Р			х		x
Pachycephalidae	Pachycephala rufiventris	Rufous Whistler	Р			х	x	
Pardalotidae	Chthonicola sagittata	Speckled Warbler	Р			х	x	x
	Pardalotus punctatus	Spotted Pardalote	Р			х	x	
	Pardalotus striatus	Striated Pardalote	Р			х	x	x
Petroicidae	Eopsaltria australis	Eastern Yellow Robin	Р				x	
	Microeca fascinans	Jacky Winter	Р				x	
	Petroica goodenovii	Red-capped Robin	Р			х		х
Podargidae	Podargus strigoides	Tawny Frogmouth	Р		х		x	
Podicipedidae	Tachybaptus novaehollandiae	Australasian Grebe	Р				x	
Pomatostomidae	Pomatostomus temporalis temporalis	Grey-crowned Babbler (eastern subspecies)	V			х		
Psittacidae	Alisterus scapularis	Australian King-Parrot	Р				x	x
	Aprosmictus erythropterus	Red-winged Parrot	Р					x
	Cacatua sanguinea	Little Corella	Р			х		
	Glossopsitta concinna	Musk Lorikeet	Р				x	x
	Platycercus adscitus eximius	Eastern Rosella	Р		х	x	x	
	Platycercus elegans	Crimson Rosella	Р				х	
	Psephotus haematonotus	Red-rumped Parrot	Р				x	

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Family	Scientific Name	Common Name	TSC	EPBC	CE	CE	CE	CE
			Act Status	Act Status	1997	2006	2009	2010
Strigidae	Ninox novaeseelandiae	Southern Boobook	Р				x	
5	Tyto alba	Barn Owl	Р		х		x	
Sturnidae	*Sturnus tristis	Common Myna	U		х		х	x
	*Sturnus vulgaris	Common Starling	U			x	х	
Sylviidae	Cincloramphus mathewsi	Rufous Songlark	Р				х	
Threskiornithidae	Platalea flavipes	Yellow-billed Spoonbill	Р		х			
	Threskiornis aethiopicus	Sacred Ibis	Р	М	х			
Turnicidae	Turnix varia	Painted Button-quail	Р				х	
Zosteropidae	Zosterops lateralis	Silvereye	Р				х	
Mammals								
Canidae	Canis lupus familiaris*	Dog	U			х		
	Vulpes vulpes*	Fox	U		х	х	x	x
Dasyuridae	Antechinus flavipes	Yellow-footed Antechinus	Р				x	
Emballonuridae	Saccolaimus flaviventris	Yellow-bellied Sheath-tailed Bat	V				x	
Felidae	Felis catus*	Cat	U			х		
Leporidae	Lepus capensis*	Brown Hare	U		x		x	
	Oryctolagus cuniculus*	Rabbit	U		х	х	х	x
Macropodidae	Macropus giganteus	Eastern Grey Kangaroo	Р		х	х	x	x

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Family	Scientific Name	Common Name	TSC	EPBC	CE	CE	CE	CE
			Act Status	Act Status	1997	2006	2009	2010
	Macropus rufogriseus	Red-necked Wallaby	Р			x	x	
	Macropus robustus	Common Wallaroo	Р				x	x
	Wallabia bicolor	Swamp Wallaby	Р				x	
Molossidae	Mormopterus "Species 4"	Undescribed Freetail Bat	Р			х		
	Mormopterus norfolkensis	Eastern Freetail-bat	V			х		
	Tadarida australis	White-striped Freetail-bat	Р			х	x	
Muridae	Mus musculus*	House Mouse	U			x	x	
	Rattus fuscipes	Bush Rat	Р				x	
	Rattus rattus*	Black Rat	U			x	x	
Petauridae	Petaurus breviceps	Sugar Glider	Р		х		x	
	Petaurus norfolcensis	Squirrel Glider	V				x	
Pteropodidae	Pteropus poliocephalus	Grey-headed Flying-fox	V	V			x	
Phalangeridae	Trichosurus vulpecula	Common Brushtail Possum	Р		х	x	x	
Tachyglossidae	Tachyglossus aculeatus	Short-beaked Echidna	Р		х			
Vespertilionidae	Chalinolobus gouldii	Gould's Wattled Bat	Р			x	x	
	Chalinolobus morio	Chocolate Wattled Bat	Р			x	x	
	Falsistrellus tasmaniensis	Eastern False Pipistrelle	V				x ^p	
	Miniopterus schreibersii oceanensis	Eastern Bentwing-bat	V			x	х	
	Myotis macropus	Large-footed Myotis	V				x	

Family	Scientific Name	Common Name	TSC Act	EPBC Act	CE 1997	CE 2006	CE 2009	CE 2010
			Status	Status		2000	2000	2010
	Nyctophilus sp.	Unidentified Long-eared bat	Ρ			x	x	
	Scotorepens orion	Eastern Broad-nosed Bat	Р			х		
	Scoteanax rueppellii	Greater Broad-nosed Bat	V				x ^p	
	Vespadelus regulus	Southern Forest Bat	Р			х		
	Vespadelus sp.	Unidentified Forest Bat	Р				x	
	Vespadelus vulturnus	Little Forest Bat	Р			х	х	
Reptiles								
Agamidae	Pogona barbata	Bearded Dragon	Р			x	x	x
Elapidae	Furina diadema	Red-naped Snake	Р				x	
	Pseudechis porphyriacus	Red-bellied Black Snake	Р			x		
	Pseudonaja textilis	Eastern Brown Snake	Р			x		
Scincidae	Acritoscincus platynota	Red-throated Skink	Р			х		
	Carlia tetradactyla	Southern Rainbow-skink	Р			х	х	
	Cryptoblepharus virgatus	Cream-striped Shinning-skink	Р			x	х	
	Egernia striolata	Tree Skink	Р			x	x	х
	Lampropholis delicata	Dark-flecked Garden Sunskink	Р			x		
	Morethia boulengeri	South-eastern Morethia Skink	Р				х	
	Saiphos equalis	Three-toed Skink	Р			x		

Family	Scientific Name	Common Name	TSC Act Status	EPBC Act Status	CE 1997	CE 2006	CE 2009	CE 2010
	Tiliqua scincoides	Eastern Blue-tongue	Р			x	х	
Varanidae	Varanus varius	Lace Monitor	Р			х	x	х

Notes:

V = Vulnerable under the TSC and EPBC Acts

P = Protected under the TSC Act

M = *Migratory under the EPBC Act*

U = Unprotected under legislation

Appendix C

Survey effort within the Mount Pleasant Project area in comparison to DECCW threatened species survey guidelines

Table C.1MINIMUM RECOMMENDED DEC (2004) FAUNA SURVEY REQUIREMENTS AND TOTAL FAUNA SURVEY EFFORT WITHIN MOUNTPLEASANT PROJECT AREA

Survey Technique	Minimum DEC (2004) effort required for wooded regions of the Mount Pleasant Project area (~900ha)	Total survey effort for the wooded regions of the Mount Pleasant Project area (900ha)
Amphibians		
Systematic day habitat search	1 hour	5 hours
Night habitat search of damp and watery sites	2 x 30 minutes on 2 separate nights	5 hours (over 4 separate nights)
Nocturnal call playback	At least one playback on each of two separate nights	3 nights
Night watercourse search	Two hours per 200m of water body edge	2 hours
Adequacy of Survey for Amphibians		Yes
Reptiles		
Habitat search	10 x 30 minute searches (2 x 30 minutes on 5 separate days)	18 x 30 minute searches (across 8 separate days)
Pitfall traps with drift nets	120 trap nights (30 traps for 4 nights)	150 trap nights
Spotlighting	10 x 30 minutes (2 x 30 minutes on 5 separate days)	2.5 hours (across five separate nights)
Adequacy of Survey for Reptiles		Yes, given the potential threatened fauna likely to
		occur in the Mount Pleasant Project area
Diurnal Birds		
Area search	Species-time curve approach	7 days with species-time curve approach + an



Table C.1MINIMUM RECOMMENDED DEC (2004) FAUNA SURVEY REQUIREMENTS AND TOTAL FAUNA SURVEY EFFORT WITHIN MOUNTPLEASANT PROJECT AREA

Survey Technique	Minimum DEC (2004) effort required for wooded regions of the Mount Pleasant Project area (~900ha)	Total survey effort for the wooded regions of the Mount Pleasant Project area (900ha)
		additional 4 hours
Water source census	A 20-minute census at dawn or dusk, for each identified water source	30 minutes at one well-forested water source
Adequacy of Survey for Diurnal Birds		Yes
Nocturnal Birds		
Call playback	Species dependant; up to 8 separate nights per site	9 nights (30 minutes each night, 1 site per night)
Day habitat search	Throughout survey period	Throughout survey period
Adequacy of Survey for Nocturnal Birds		Yes
Non-Flying Mammals		
Small Elliott traps	1000 trap nights (250 traps over 4 nights)	500 trap nights
Large Elliott traps	1000 trap nights (250 traps over 4 nights)	-
Arboreal Elliott traps	240 trap nights (60 traps across 4 nights)	510 trap nights
Wire cage traps	240 trap nights (60 traps across 4 nights)	3 nights
Pitfall traps with drift nets	240 trap nights (60 traps across 4 nights)	150 trap nights
Terrestrial Hair tubes	800 trap nights (200 hairtubes for 4 nights)	3,001 trap nights
Arboreal hair tubes	1,200 trap nights (300 hairtubes for 4 nights)	1,350 trap nights
Spotlighting on foot	10 x 1 hour (2 x 1 hour on 5 separate nights)	20 hours (10 x 2 hours per night on 10 separate nights) + 3 additional nights



Table C.1MINIMUM RECOMMENDED DEC (2004) FAUNA SURVEY REQUIREMENTS AND TOTAL FAUNA SURVEY EFFORT WITHIN MOUNTPLEASANT PROJECT AREA

Survey Technique	Minimum DEC (2004) effort required for wooded regions of the Mount Pleasant Project area (~900ha)	Total survey effort for the wooded regions of the Mount Pleasant Project area (900ha)
Spotlighting from vehicle	10 x 1 hour (2 x 1 hour on 5 separate nights)	5 hours (5 x 1 hours per night)
Call playback	10 sites for 2 nights each	9 nights
Search for scats and signs	2.5 hours	3 hours
IR cameras	-	12 survey nights
Collection of predator scats	Throughout survey period	Throughout survey period
Adequacy of Survey for Non-flying Mammals		Yes, given the potential threatened fauna likely to occur in the Mount Pleasant Project area
Bats		
Harp trapping	40 trap nights	48 trap nights
Ultrasonic call recording	20 sites for 2 nights each	14 nights
Trip lining	-	-
Day habitat search	Throughout survey period	Throughout survey period
Adequacy of Survey for Bats		Yes given the number of harp trapping nights undertaken within the Mount Pleasant Project area

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