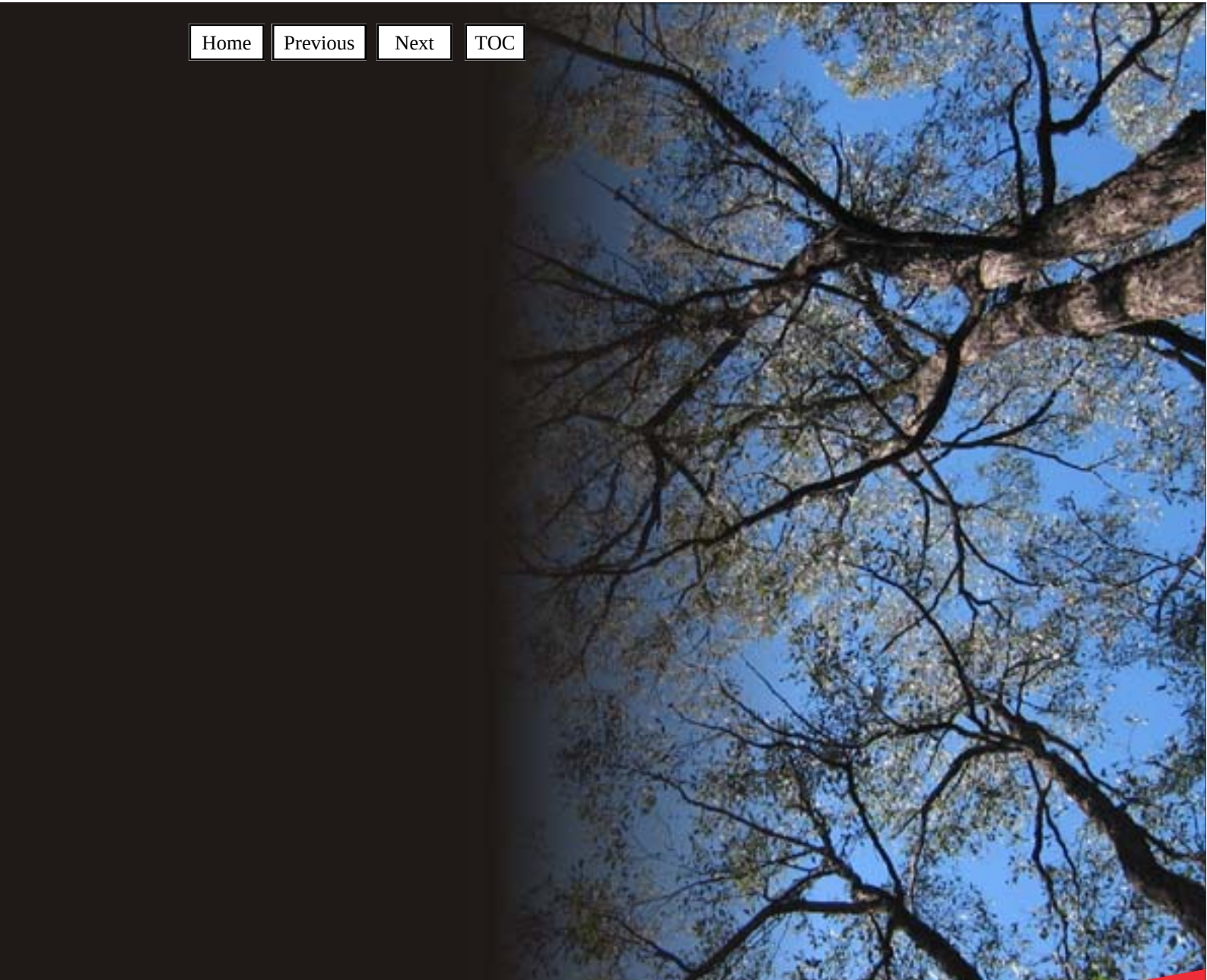

APPENDIX 9

Ecology Assessment

Readymix Holdings Pty Limited

Ecological Assessment
Proposed Lynwood Quarry, Marulan

May 2005

Umwelt
Environmental Consultants

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1.0 INTRODUCTION

Readymix Holdings Pty Limited (Readymix) proposes to establish a hard rock quarry on its land to the west of Marulan in the Southern Tablelands of New South Wales (NSW) (refer to **Figure 1.1**). The proposed Lynwood Quarry (the project) will be located approximately 160 kilometres southwest of Sydney and approximately 27 kilometres northeast of Goulburn. The Readymix land holding totals approximately 1000 hectares, the majority of which is a grazing property known as 'Lynwood'. An aerial photograph of the project area is included as **Figure 1.2**.

The project area not only contains a substantial, high quality hard rock resource, but also has ready access to key transport infrastructure. The Main Southern Railway bisects the project area and the Hume Highway adjoins Readymix's southern boundary (refer to **Figure 1.2**). Readymix has a sound knowledge of the hard rock resource, due to both an extensive exploration drilling program and experience from operation of the existing Johniefelds quarry, located on Brayton Road approximately 2 kilometres north of the project area.

The proposed quarry is intended to provide a long-term supply of high quality construction material into the Sydney, regional and local markets. The proposed supply to the Sydney market will replace Readymix's current production from the Penrith Lakes Scheme which is likely to be exhausted around 2010. The proposed quarry is planned to produce approximately 5 million tonnes per annum (Mtpa) with an expected life of in excess of 90 years. Approval will be sought for an initial period of 30 years.

1.1 PROJECT AREA

The project area is currently used for cattle grazing, except for the transport corridors and an area on the eastern boundary of the property which is leased by Readymix to Orica Explosives and is occupied by a bulk storage depot. A substantial portion of the northern part of the project area is occupied by woodland, with the majority of the remainder being cleared grazing land with scattered patches of remnant woodland. The project area is surrounded primarily by grazing land, with a rural residential area under development adjacent to the northeastern boundary and existing residential areas associated with the township of Marulan further to the east. The project area is situated in an area that supports fragmented woodland, open forest and derived pasture, consistent with much of the Southern and Central Tablelands of NSW.

The project area is drained by three main creeks (refer to **Figure 1.2**): Marulan Creek runs along the southeastern boundary and supports a riparian woodland; the partially wooded Joarimin Creek exits the project area in the central northeast, and drains most of the project area through smaller, largely cleared tributaries; and Lockyersleigh Creek is situated in the far northwest of the project area, flowing southwest, and is partly vegetated with a riparian woodland. All three creeks are ephemeral and during the ecological survey periods retained only small ponds of water in isolated stretches.

1.2 PROPOSED DEVELOPMENT

The project is intended to provide a long-term supply of high quality construction material into the Sydney, regional and local markets. The proposed supply to the Sydney market will replace Readymix's current production from the Penrith Lakes Scheme which is likely to be exhausted by approximately 2010. It is proposed that the Lynwood Quarry will produce up to 5 Mtpa of hard rock aggregate with an expected life of in excess of 90 years. Initial approval will be sought for a 30 year quarry period.

The conceptual design for Lynwood Quarry has evolved throughout the environmental impact assessment (EIA) process in light of ongoing exploration and geological modelling work, environmental constraints and opportunities and in consideration of stakeholder consultation

FIGURE 1.1

Locality Plan

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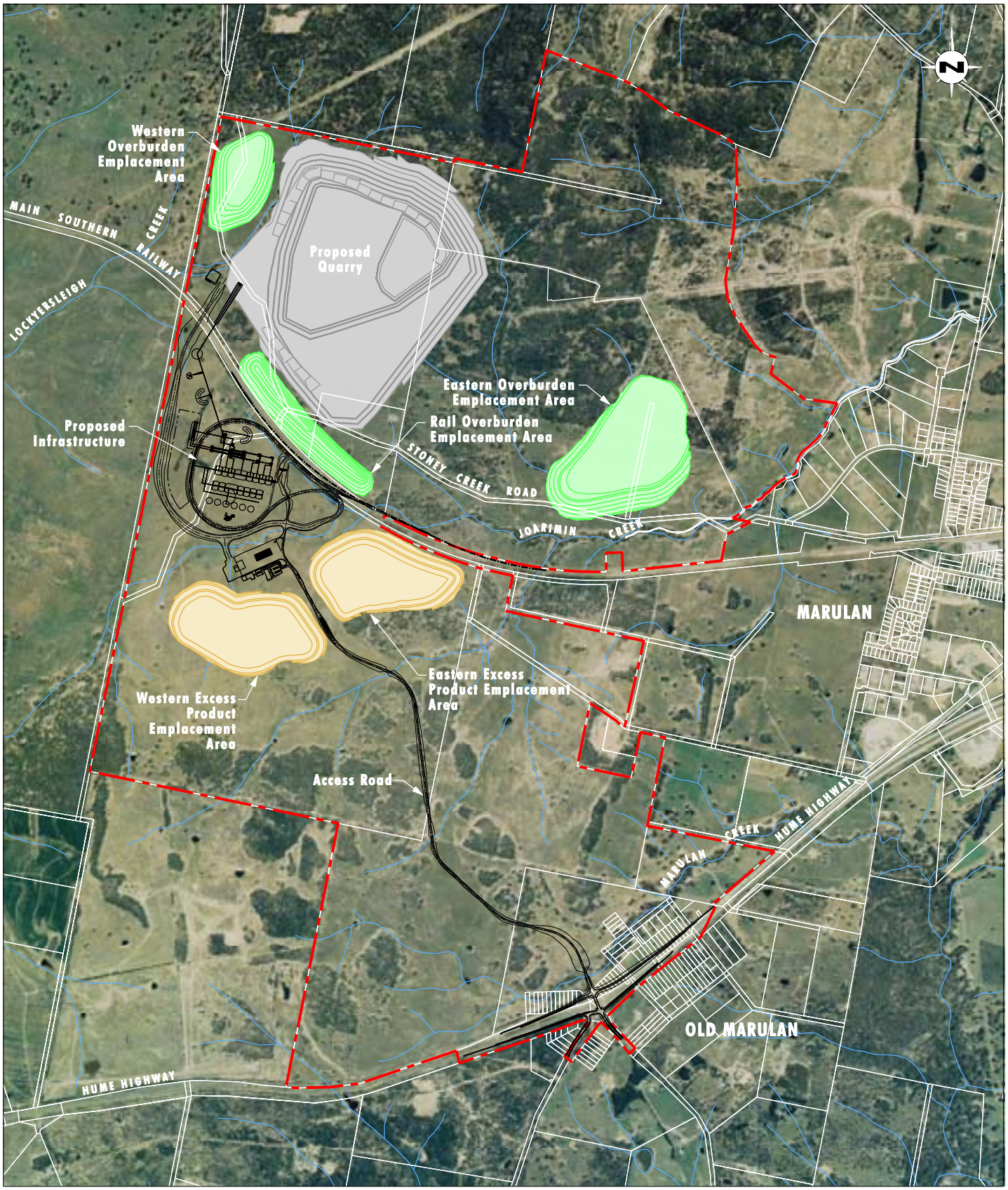


Base Source: LPI 2004, Readymix Holdings Pty Ltd (Aerial Photo March 2005)

0 0.5 1 1.25km

Legend

Project Area

FIGURE 1.2

Project Area and Proposed Quarry Layout at Year 30

outcomes. A description of the conceptual features that comprise the project are included in the following sections.

1.2.1 Construction Phase

As Lynwood Quarry is a greenfields project (that is, there is not currently any quarrying activity at the site), substantial construction works will be required prior to the quarry becoming operational. The construction phase is expected to last approximately two years and will include the following key activities:

- construction of initial site access road and set-up of construction compounds including supply of services (e.g. electricity, water, etc.);
- setup of mobile concrete and crushing plants;
- construction of the Hume Highway interchange and permanent site access road;
- construction of the rail overpass;
- extraction of material from the primary crusher area;
- excavations for the rail loop and reclaim tunnel;
- construction of the crushing plant, rail facility, truck loading facility and other infrastructure;
- construction of rail lines and connection to the Main Southern Railway;
- construct remaining facilities including workshops, site offices, amenities, laboratory, weighbridge, stores, parking areas, site roads, safety bunds, etc.;
- construction of water management structures and installation of pumps, pipelines etc; and
- installation of security fencing and gates to ensure public safety and security for the quarry operations.

1.2.2 Operational Phase

Over the initial 30 year operation period, the project will produce approximately 145 Mt of quarry product. Some of the material extracted as part of the quarrying process will not be suitable for sale and consequently emplacement areas will be required. This material consists of both overburden material which will be excavated and taken directly to emplacement areas without passing through the crushing and screening plant and also material generated at various phases of the crushing and screening process. Due to the depth of the resource and the number of years which will be required in order to reach a terminal face, in-pit dumping will not be possible during the initial 30 year quarry period without sterilising future resources and therefore, all emplacement areas are planned to be out-of-pit.

The footprint of the conceptual quarry plan and associated infrastructure for the Year 30 is shown on **Figure 1.2**.

The quarrying process will involve the following broad steps:

- clearing and topsoil stripping;

- drill and blast – percussion drill drilling holes to a bench height of approximately 15 metres. Approximately one blast will be required each week in order to meet production requirements; and

- the resultant material from the blast will be loaded by front-end loaders into dump trucks and transported to the crushing and screening plant.

Three overburden emplacement areas have been designed to accommodate the overburden material removed during the initial 30 year quarrying period. These three dumps are shown on the Year 30 conceptual quarry plan (refer to **Figure 1.2**) and are known as the Railway Overburden Emplacement Area, the Eastern Overburden Emplacement Area and the Western Overburden Emplacement Area. The overburden emplacement areas will require vegetation clearance and topsoil stripping prior to development.

1.3 OBJECTIVES

The objectives of the ecological assessment were to:

- record the flora and fauna communities in the project area;

- identify any threatened or regionally significant flora and fauna, especially those listed under Schedules 1 and 2 of the NSW *Threatened Species Conservation Act* 1995 and the Commonwealth *Environment Protection and Biodiversity Conservation Act* 1999;

- assess the impact that the proposal will have on the flora and fauna communities recorded in the project area; and

- provide recommendations for the management of flora and fauna species and communities, including threatened species.

2.0 SURVEY METHODOLOGY

Prior to the commencement of flora and fauna field surveys, searches of the Department of Environment and Conservation (DEC) Atlas of NSW Wildlife Database and the Commonwealth Department of Environment and Heritage (DEH) *Environment Protection and Biodiversity Conservation Act* 1999 (EPBC Act) Protected Matters Database, and a review of existing studies from the local area, were undertaken.

2.1 FLORA

In order to account for likely seasonal variation, two spring flora surveys and a winter survey were undertaken. Week-long surveys were undertaken in November 2003 and September 2004, with a three day survey undertaken in July 2004. Multi-seasonal surveying was undertaking to assist in the detection of a broad range of species which may otherwise have been overlooked because of flowering or fruiting times. Limitations to the survey as a result of drought, and biases typically associated with data collection, are discussed in **Section 2.1.3**.

Surveys considered and targeted threatened flora species and endangered ecological communities known or with potential to occur in the local area. No endangered populations occur in the local area.

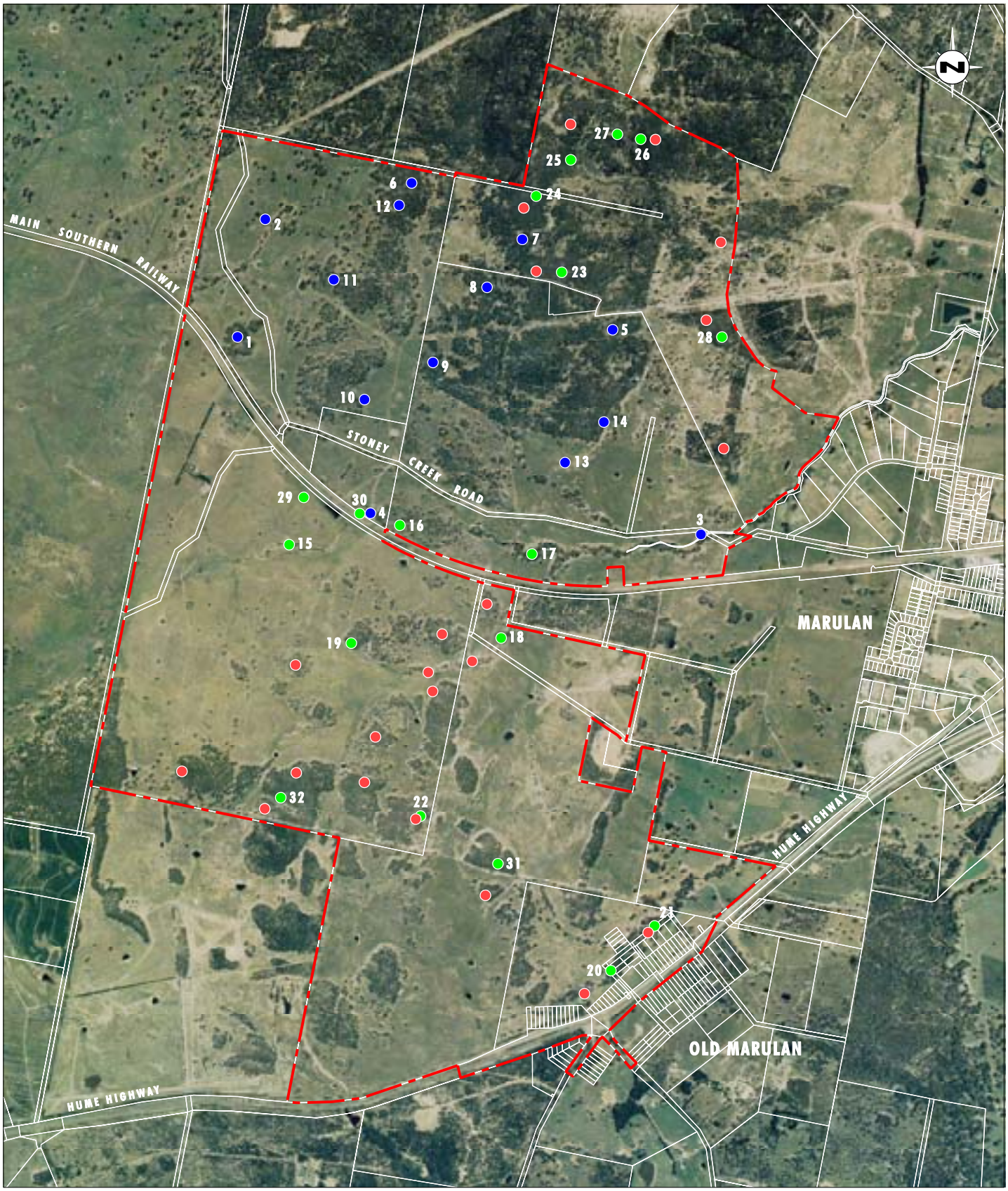
2.1.1 Vegetation Survey

On the completion of a preliminary reconnaissance of the project area in November 2003, a systematic flora survey was undertaken in the northern portion of the project area (north of the railway) to sample the vegetation of that part of the project area. The locations of the 14 vegetation quadrats completed during the vegetation survey are shown on **Figure 2.1**. In addition to these, walking transects were undertaken across the remainder of the project area to assist in the definition of vegetation community boundaries and to detect potentially occurring threatened species.

Surveys in June 2004 consisted of 22 random meander walking transects undertaken across the project area (refer to **Figure 2.1**). These assessments comprised a categorisation of each remnant patch into a vegetation community classification, as well as a survey for threatened flora species. During September 2004 a further 18 systematic vegetation plots were sampled, primarily in the area south of the railway, as well as in the northeastern portion of the project area (refer to **Figure 2.1**). Again, walking transects were undertaken across the remainder of the area to assist in the definition of vegetation community boundaries and to detect potentially occurring threatened species.

At each site a 400 m^2 plot was established and surveyed thoroughly for vascular flora species. In most cases the plot dimensions were 20 x 20 metres, however in some riparian areas a 10 x 40 metre plot was established, taking into account the linear nature of such communities. Estimates of crown coverage and projective foliage cover were made using the visual calibration chart developed by Walker and Hopkins (1990).

At each site roughly 1 hour was spent searching for all vascular flora species present within each plot. Species located outside the plot were marked as being present but were not assigned a cover-abundance value. Species within the plot were assigned a cover-abundance value to reflect their relative cover and abundance in the plot. A modified Braun-Blanquet 6-point scale (Braun-Blanquet 1927, with selected modifications informed by Poore 1955 and Austin et al. 2000) was used to estimate cover-abundances of all plant species within each plot. **Table 2.1** shows the cover-abundance categories used.



Base Source: LPI 2004, Readymix Holdings Pty Ltd (Aerial Photo March 2005)

0 0.5 1 1.25km

Legend

- Project Area
- Vegetation Quadrat (2003)
- Vegetation Quadrat (2004)
- Random Meander Location

FIGURE 2.1

Flora Survey

File Name (A4): R01_V1/1829_065.dgn

Table 2.1 - Modified Braun-Blanquet Crown Cover-abundance Scale

Class	Cover-abundance*	Notes
1	Few individuals (less than 5% cover)	Herbs, sedges and grasses: < 5 individuals. Shrubs and small trees: < 5 individuals.
2	Many individuals (less than 5% cover)	Herbs, sedges and grasses: 5 or more individuals. Shrubs and small trees: 5 or more individuals. Medium-large overhanging tree.
3	5% – less than 20% cover	
4	20% – less than 50% cover	
5	50% – less than 70% cover	
6	70% – 100% cover	

Note: * Modified Braun-Blanquet scale (Poore 1955; Austin et al. 2000)

Records were made of vegetation structure, dominant and characteristic flora species, and other flora species across the project area at both plot sampling sites and by completion of walking transects. Those species not readily recognisable in the field were collected for subsequent identification. Specimens that were difficult to identify were forwarded to the National Herbarium of NSW for specialist identification. Specimens of *Pomaderris* were identified by Neville Walsh of the National Herbarium of Victoria. Voucher specimens were collected for most species.

2.1.2 Plant Identification and Taxonomic Review

All vascular plants recorded or collected were identified using keys and nomenclature in Harden (1992, 1993 2000a & 2002) and Wheeler et al. (2002). Where known, changes to nomenclature and classification have been incorporated into the results, as derived from *Plantnet* (Botanic Gardens Trust 2005), the on-line plant name database maintained by the National Herbarium of NSW. Names revised since Harden (1992, 1993, 2000a & 2002) that are relevant to this study are listed in **Table 2.2**.

Table 2.2 - Revisions or Additions to Botanical Nomenclature Relevant to this Report

Species/Group Revised	Reference
Agrostis revision and instalment of *Lachnagrostis*	Jacobs (2001)
Billardiera revision	Cayzer et al. (2004)
Bursaria revision	Cayzer et al. (1999)
Conyza revision	Walker (1971)
Danthonia/*Austrodanthonia*/*Notodanthonia* revisions (includes *Chionochloa* revision)	Linder & Verboom (1996); Linder (1997)
Gnaphalium revision and transferral to *Euchiton* and *Gamochaeta*	Anderberg (1991)
Stipa/*Austrostipa* revision	Jacobs & Everett (1996)
Verbena revisions	Michael (1995, 1997a & 1997b); Munir (2002)

Common names used follow Harden (1992, 1993, 2000a & 2002) where available, and draw on other sources such as local names where these references do not provide common names.

2.1.3 Biases and Limitations

While surveys were undertaken to comply with relevant guidelines and industry standards, it was not possible to completely remove the effects of bias or seasonal limitations from the surveys. The

placement of the survey quadrats and the transect routes resulted in some unavoidable bias, as site selection is always affected by subjective decisions. Floristic surveys are always affected by seasonal influences. The allocation of a number of specimens to species or infra-specific levels was limited by the availability of flowering or fruiting material, or both. This particularly occurred with herbaceous and graminoid species, such as those belonging to the families Asteraceae, Cyperaceae, Orchidaceae and Poaceae.

Some ephemeral species and late winter-flowering geophytes, such as terrestrial orchids, may not have been detected during winter, spring and early summer sampling because of the absence of new growth or inflorescences. This meant that annual and rhizomatous or tuberous species which lack above-ground structures during dormancy are likely to have been under-represented. However, all threatened flora species with the potential to occur in the project area typically flower during the periods of time over which botanical surveys were conducted, and were therefore adequately covered by the survey.

The district was affected generally by a severe drought during all survey periods. As a result, the groundcover at most sites was very low in biomass, and the detectability of many species was greatly reduced, because they were probably restricted to below-ground tubers and rhizomes, with little surface material.

Taking the above into account, however, the flora survey design, survey effort and allowance for temporal and seasonal variation resulted in the completion of a detailed survey which provides comprehensive data on which to undertake an impact assessment for the project.

2.1.4 Target Species

In conjunction with sampling the vegetation communities present in the project area, a key objective of the survey was to search for significant flora species considered to potentially occur in the project area. These species were selected based on a search of the DEC Atlas of NSW Wildlife database, and the EPBC Protected Matters Search Database, as well as through a review of existing studies from the local area and an examination of other threatened flora species known to occur more broadly in similar habitats on the Goulburn and Moss Vale 1:100,000 topographic sheets. As a result of these assessments, particular species that were searched for included those listed in **Table 2.3**.

Table 2.3 - Target Threatened Flora Species

Scientific Name	Common Name	Record
Caladenia tessellata	thick-lipped spider orchid	EPBC, WA1
Diuris aequalis	buttercup doubletail	EPBC, WA1
Diuris tricolor	tricolour donkey orchid	WA1
Eucalyptus aquatica		WA2
Genoplesium plumosum	plumed midge-orchid	EPBC, WA1
Haloragis exalata subsp. *exalata*	wingless raspwort	EPBC, WA1
Kunzea cambagei		EPBC, WA1
Pomaderris cotoneaster		WA2
Pomaderris delicata		WA1
Thesium australe		EPBC, WA1

Notes: EPBC = recorded from within a 10 km radius on the EPBC Protected Matters database.
WA1 = recorded from within a 10 km radius on the DEC Wildlife Atlas.
WA2 = recorded from the Moss Vale and/or Goulburn 1:100,000 map sheets on the DEC Wildlife Atlas, and utilises habitat similar to that in the project area.

Camden Woollybutt (*Eucalyptus macarthurii*) was not listed in any of the above sources, either because it was not recorded by them or because it was not preliminarily listed under the TSC Act as a

vulnerable species at the time of the search. This species was, however, located in the project area (refer to **Section 3.1.2**).

In addition to the plot based surveys, walking transects were undertaken over a three day period in July 2004 to identify the presence of significant species or communities within the project area. The location of the random meander transects are also shown on **Figure 2.1**.

2.2 FAUNA SURVEY

As with the vegetation survey, two spring fauna surveys and a winter survey were undertaken in order to account for seasonal and temporal variations in fauna populations within the project area. Week long surveys were undertaken in November 2003 and September 2004, with a three day survey undertaken in July 2004.

All surveys considered and targeted threatened fauna species known to occur in the local area.

2.2.1 Mammals

2.2.1.1 Spotlighting

A total of 34 person hours of spotlighting were conducted during spring and winter. The sites and transects in which spotlighting was undertaken are shown on **Figure 2.2**. Spotlighting was undertaken for a total of 16 person hours during the spring 2003 survey, with an additional four person hours conducted during the July 2004 survey and 12 person hours during the September 2004 survey. Spotlighting was primarily conducted on foot using a 50 watt hand-held spotlight, with some areas also covered by spotlight from a slow moving vehicle. Spotlighting was generally undertaken between 7:30 pm and 11:30 pm. The spotlight searches targeted arboreal mammals such as possums and gliders, as well as nocturnal birds, herpetofauna, bats and terrestrial mammals.

2.2.1.2 Trapping

The primary aim of fauna trapping was to detect arboreal and ground dwelling mammals. Six trap lines were set in the northern portion of the project area during the spring 2003 survey with trapping undertaken over four consecutive nights The traplines all included ten Elliot 'A' traps, four Elliot 'B' arboreal traps, seven hair funnels and one cage trap. Forty hair funnels were also set during the winter survey for a period of 10 nights, specifically targeting the threatened squirrel glider (*Petaurus norfolcensis*). The September 2004 survey focused on the southern portion of the project area with four sites sampled utilising the full range of traps (10 terrestrial Elliot A traps, four arboreal Elliot B traps and four terrestrial cage traps) , and an additional pasture site sampled with ten terrestrial Elliot 'A' ground traps and two terrestrial cage traps. Forty hair funnels set during September 2004 were removed 15 days later. **Table 2.4** indicates the total number of trap nights used during the survey and **Figure 2.2** shows the locations of each of the fauna trapping sites.

Table 2.4 - Number of mammal trap nights during each survey

Trap Type	Trap Nights November 2003 Survey	Trap Nights July 2004 Survey	Trap Nights September 2004 Survey
Elliot class 'A'	240	-	200
Elliot class 'B'	96	-	64
Cage traps	24	-	72
Hair funnels	168	400	600
Total Trap Nights	**528**	**400**	**936**

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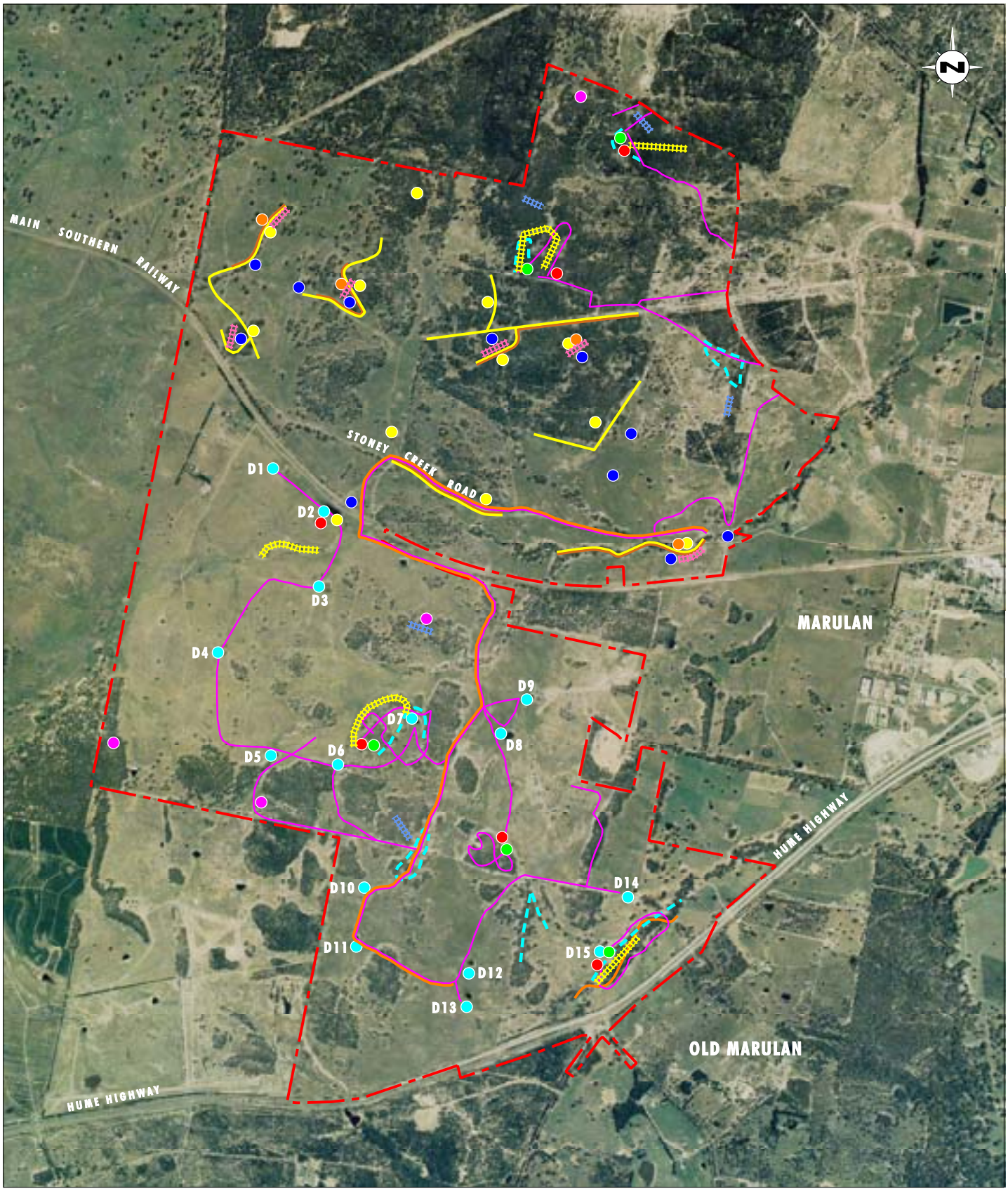


Base Source: LPI 2004, Readymix Holdings Pty Ltd (Aerial Photo March 2005)

0 0.5 1 1.25km

Legend

- Project Area
- Trapline (Sept 2003)
- Spotlighting Transect (Sept 2003)
- Anabat Transect (Sept 2003)
- Owl Call Playback (Sept 2003)
- Herpetological Survey Points (Sept 2003)
- Diurnal Bird Survey (Sept 2003)
- Spotlighting (July 2004)
- Diurnal Bird Survey (July 2004)
- Hair Funnel Transect (July 2004)
- Amphibian Survey Point (Sept 2004)
- Diurnal Bird Survey (Sept 2004)
- Spotlighting (vehicle/foot) (Sept 2004)
- Call Playback (Sept 2004)
- Anabat Site (Sept 2004)
- Trapeline (Sept 2004)

FIGURE 2.2

Fauna Survey

File Name (A4): R01_V1/1829_070.dgn

Elliot 'A' traps were set as ground traps in order to sample ground dwelling fauna populations at each site. Elliot 'B' traps were mounted in trees to target arboreal fauna where trees were of sufficient size, however where these were absent, traps were laid on the ground. Elliot 'A' traps were set at intervals of 10 metres, and Elliot 'B' traps at 20 metre intervals. Arboreal fauna were also targeted by mounting hair funnels on tree trunks within the project area. Hair funnels are a modification of hair tubes, being shaped so as to allow hair from animals of any size to be captured for later analysis. The trap lines remained in place for four consecutive nights.

The Elliott traps and hair funnels were baited with a standard mix of rolled oats, honey, and peanut butter. Cage traps were set with a mixture of peanut butter and sardine cat food. A honey emulsion (comprising honey and water) was sprayed daily onto each tree containing an arboreal trap or hair funnel. The honey emulsion was also sprayed on nearby trees to act as an attractant.

2.2.1.3 Bats

A total of 11 microchiropteran bat detection walking transects were conducted during the survey period. The Anabat II system was used for these surveys. Each of the walking transects (the location of which are shown in **Figure 2.2**) were 45 minutes in duration with all detected calls recorded to tape for later analysis. All Anabat recordings were analysed by Glenn Hoye of Fly by Night Surveys Pty Limited. A 50 watt hand-held spotlight was used during the survey to locate any megachiropteran bat species present.

2.2.1.4 Mammal Traces

Searches for evidence of mammal use were also conducted, with scats collected and analysed as required. Trees were examined for scratch marks and other evidence of use by arboreal mammals. All hair and scat analysis was undertaken by Barbara Triggs. Opportunistic mammal observations during other aspects of the survey were also recorded.

2.2.1.5 Call Playback

The call playback sessions followed the method recommended by Forest Fauna Surveys et al. (2001), and included the calls of the sugar glider (*Petaurus breviceps*), squirrel glider (*Petaurus norfolcensis*), koala (*Phascolarctos cinereus*) and yellow-bellied glider (*Petaurus australis*). The sessions commenced with a quiet listening period of approximately 15 minutes, following which the first call was played. The broadcast of each call was followed by a quiet listening period of two to five minutes, and then by approximately five minutes of spotlighting in the vicinity of the call playback site at the completion of call playback. The calls were broadcast using a 10 watt directional loud hailer.

2.2.2 Herpetofauna

Targeted diurnal searches were conducted for reptile and amphibian species in likely habitat areas throughout the project area. During the search likely microhabitats were examined including beneath rocks and logs, in tree bark, in ground litter and in wet soak areas. The diurnal surveys were conducted in the afternoon periods between 12.00 pm and 4.00 pm. Pit fall trapping was not undertaken due to the dominant rocky substrate within the project area.

Frog calls were opportunistically identified during all activities undertaken within the project area, including spotlighting, flora surveys and while checking fauna traps. Recorded calls were later identified with the aid of 'Australian Frogcalls of the Subtropical East', by David Stewart.

During September 2004, nocturnal herpetological surveys focusing on amphibian species were conducted at 15 farm dams in the southern portion of the project area (refer to **Figure 2.2**). Each dam was approached at an angle that prevented vehicle lights from shining on the water body. An initial

listening period of two to five minutes was undertaken before a minimum one metre band around the entire circumference of the dam adjacent to the water edge was searched on foot by two surveyors.

2.2.3 Nocturnal Birds

A total of nine owl call-playback sessions were conducted during the fauna surveys to determine the presence of nocturnal bird species (in particular threatened species). In addition to this, 34 person hours of spotlighting were completed throughout the project area, with nocturnal birds being among the target species.

The owl call playback sessions followed the method recommended by Forest Fauna Surveys et al. (1997), and included the calls of the powerful owl (*Ninox strenua*), masked owl (*Tyto novaehollandiae*) and barking owl (*Ninox connivens*). The sessions commenced with a quiet listening period of approximately 15 minutes, following which the first owl call was played. The broadcast of each owl call was followed by a quiet listening period of five minutes, and then by approximately five minutes of spotlighting in the vicinity of the owl call playback site. The calls were broadcast using a directional 10 watt loud hailer

2.2.4 Diurnal Birds

Diurnal bird surveys each of 30 to 60 minutes duration were undertaken during each of the survey periods, for a total of 16.5 person hours of survey. The surveys were undertaken at 19 survey points (refer to **Figure 2.2**) in a range of different habitat types at various times of the day, primarily in early morning and late afternoon. Opportunistic observations were also recorded during other aspects of the field survey, particularly while checking trap lines each morning and while undertaking vegetation quadrats. Individual bird species were identified from characteristic calls and by observation using 10 x 40 binoculars.

3.0 RESULTS

3.1 FLORA

3.1.1 Vegetation of the Region

The project area lies within the South Eastern Highlands Bioregion which lies just inland of the Coastal South East Corner and Sydney Basin bioregions. It is bounded by the Australian Alps Bioregion to the south and the South Western Slopes Bioregion to the west (NSW NPWS 2003). The South Eastern Highlands Bioregion is characterised by a temperate climate with warm summers and no dry season.

The vegetation of this bioregion varies across the landscape according to geology, temperature and rainfall, and has been extensively cleared for agriculture and urban development. The diversity of the landscape has resulted in a variety of Woodland/Open Forest communities with different eucalypt associations. Some of the dominant canopy species in these communities include yellow box (*Eucalyptus melliodora*), red box (*E. polyanthemos*), Blakely's red gum (*E. blakelyi*), white box (*E. albens*), red stringybark (*E. macrorhyncha*) and broad-leaved peppermint (*E. dives*). There are also small patches of Argyle apple (*E. cinerea*) occurring in habitats around Goulburn. Creeklines within this bioregion are typically dominated by river oak (*Casuarina cunninghamiana* subsp. *cunninghamiana*) (NSW NPWS 2003).

Extensive grassland communities are characteristic of this bioregion, particularly on the driest plains of the Monaro. Species typical of this grassland vegetation include snow grass (*Poa sieberiana*), spear grasses (*Austrostipa scabra, A. variabilis*) and kangaroo grass (*Themeda australis*).

The South Eastern Highlands bioregion is dissected into a number of smaller sub-bioregions. The project area lies within the Bungonia sub-bioregion. The landforms characteristic of this region include strong, linear ridges occurring on sandstone and volcanic geologies, wide valleys with some cold air drainage and inverted tree lines. Typical eucalypt species occurring within the open forests of the Bungonia sub-bioregion include broad-leaved peppermint (*E. dives*), white gum (*E. viminalis*), red stringybark (*E. macrorhyncha*), brittle gum (*E. mannifera* subsp. *mannifera*) as well as occasional areas of Argyle apple (*E. cinerea*).

Within the South Eastern Highlands Bioregion, there are numerous conservation reserves, covering approximately 14% of the land area (NSW NPWS 2003). The reserves closest to the project area include: Bungonia State Conservation Area (SCA), occurring approximately 17 kilometres south of Marulan; Morton National Park, occurring approximately 15 kilometres southeast of Marulan; and Tarlo River National Park occurring approximately 43 kilometres northwest of Marulan.

Bungonia SCA covers an area of 3977 hectares with woodland communities occurring on the ridges and steep slopes, open forest on moderate slopes and plateaux and rainforest in the gullies (NSW NPWS 1998). Typical woodland and open forest species in the SCA include coast grey box (*Eucalyptus bossistoana*), Argyle apple (*E. cinerea*), brittle gum (*E. mannifera* subsp. *mannifera*), cabbage gum (*E. amplifolia* subsp. *amplifolia*) and thin-leaved stringybark (*E. eugenoides*). Those species dominating the creeklines include forest red gum (*E. tereticornis*) and red stringybark (*E. macrorhyncha*) (NSW NPWS 1998).

Morton National Park covers an area of approximately 190,000 hectares and contains a number of native vegetation communities. Extensive areas of tall forest occur on sheltered slopes, siltstone benches, in gullies and gorges throughout most of the park. Dominant species include: brown barrel gum, white ash, white-topped box, grey gum, Sydney peppermint, spotted gum (*Corymbia maculata*) and forest red gum. In drier and more exposed locations open forest occurs. This has many species in common with the tall forest but tends to be dominated by: bloodwoods, silver-top ash, blue-leaved stringybark, white stringybark and yertchuk in the driest places. Mallee woodlands are widespread on benches in the Ettrema plateau and exposed ridges in the Budawangs. Rainforest occurs in sheltered

locations such as moist south or east facing slopes, the heads of gullies and on fertile soils such as along creeks, on the Illawarra coal measures and the northern end of the park. It occurs mainly in small patches, but there are extensive areas along the Kangaroo Valley escarpments. In the Shoalhaven Gorge between Bungonia Creek and Tallowa Dam the main species are red cedar, Port Jackson Fig and white cedar. Cool temperate rainforest occurs in very small patches at the highest elevations at the northern end of Morton National Park and extensively in the middle on high slopes in the Budawang Range. Extensive areas of wet heath and sedgeland occur in poorly drained areas (NSW NPWS 1998).

Tarlo River National Park covers an area of approximately 8000 hectares. Vegetation communities that have been mapped in the Park are described in the Tarlo River National Park Plan of Management (NSW NPWS 1998). These include:

- open forest and woodland communities of stringybarks *Eucalyptus agglomerata* and/or *E. macrorhyncha* occur on the ridges and dry slopes of most of the park. Common associated species are silvertop ash (*E. sieberi*) and brown stringybark (*E. blaxlandii*). Grey gum (*E. punctata*) occurs with the stringybarks in the northern part of the park where rainfall is higher. Narrow-leaved peppermint (*E. radiata*), Argyle apple (*E. cinerea*) and bundy (*E. goniocalyx*) occur occasionally. The understorey is open, particularly on western slopes, as a result of the cool dry climate, the occurrence of surface rock and previous fires. Common shrubs include peach heath (*Lissanthe strigosa*), lance beard-heath (*Leucopogon lanceolatus*), finger hakea (*Hakea dactyloides*), narrow-leaved geebung (*Persoonia linearis*), sunshine wattle (*Acacia terminalis*) and *A. obtusifolia*;

- more sheltered slopes and gullies support brittle gum (*Eucalyptus mannifera* subsp. *mannifera*) – western scribbly gum (*E. rossii*) forest and woodland communities. Common associated species are red stringybark (*E. macrorhyncha*) and blue-leaved stringybark (*E. agglomerata*) on upper and middle slopes and broad-leaved peppermint *E. dives* on lower slopes. Grey gum and Argyle apple also occur;

- scribbly gum woodland is almost mono-specific on broad, lower ridges and slopes and sometimes contains a dense layer of shrubs. Associated with the scribbly gum woodland are patches of *Allocasuarina nana* heathland in the southwestern part of the park. This community is composed of a dense stand of *A. nana* with various other shrubs such as *Leptospermum* species;

- small areas of shrub and herb communities occur where surface rock or steep slopes prevent tree growth. The shrub communities commonly contain *Pultenaea microphylla, Daviesia leptophylla, Hibberta* spp*., Indigofera australis, Patersonia sericea* and *Xanthorrhoea* sp.

  The herbfields are species rich, some common species being *Acaena anserinifolia*, *Dichondra* spp., *Drosera* spp*., Geranium* spp*., Glycine* spp*., Lissanthe* spp*., Ranunculus* spp*., Stellaria* spp*., Stylidium* spp*., Stypandra* spp., plus ferns and orchids;

- several forest communities occur in small areas on the moister and deeper floors of the valleys, particularly along the Tarlo River. Those identified are: manna gum (*E. viminalis*) tall open forest on and adjacent to alluvial flats; river peppermint (*E. elata*) open forest at the heads of some gullies in the northwestern and southeastern parts of the park; Blakely's red gum (*E. blakelyi*) - yellow box (*E. melliodora*) open forest on better soils such as in the Kerrawary Creek area; apple box (*E. bridgesiana*), long-leaved box and coastal grey box (*E. bosistoana*) woodland on lower slopes and flats adjacent to the Tarlo River; Argyle apple woodland in small pure stands along valley floors and gentle slopes; and galleries of river oak (*Casuarina cunninghamiana* subsp. *cunninghamiana*) along the Tarlo River and its major tributaries. Small cleared areas occur at scattered locations in the park, primarily along the Tarlo River and adjacent to Kerrawary Creek near the park boundary. Regeneration is slowly occurring;

- areas of Permian sediments in the southeastern section of the park support vegetation communities different to those found elsewhere in the park and which are uncommon in the district. Several

species occur in very low numbers in this area. While they are widespread in other parts of the State and not endangered, inappropriate management could lead to their disappearance from the park and possibly the district;

- the rare species *Acacia subtilinervis* is found on the conglomerate outcrops. Open forest of red bloodwood (*Corymbia gummifera*), silvertop ash, grey gum and red stringybark with a sparse understorey occurs on the ridges and dry slopes. Open forest of blue-leaved stringybark with a moderately dense shrub layer is found on the more sheltered slopes. River peppermint, red bloodwood and blue-leaved stringybark forest occurs in the gullies, with a dense understorey of ferns; and

- other tree species in this area are western scribbly gum, white stringybark *E. globoidea*, Sydney peppermint (*E. piperita*), scribbly gum, manna gum, Argyle apple, and Blue Mountains mallee (*E. stricta*). Understorey plants include forest phebalium (*Phebalium squamulosum*), prickly shaggy pea (*Podolobium ilicifolium*), grass tree (*Xanthorrhoea australis*), rock lily (*Dendrobium speciosum*), spreading wattle (*Acacia genistifolia*), sticky boronia (*Boronia anemonifolia*), *Zieria cytisoides*, hairpin banksia (*Banksia spinulosa*), *Pimelea linifolia* and *Patersonia glabrata.*

3.1.1.1 DIPNR & DEC Regional Vegetation Mapping

The Department of Infrastructure, Planning and Natural Resources (DIPNR) and DEC have produced a draft vegetation map of the Goulburn and Moss Vale 1:100,000 sheets, as part of a broader vegetation map covering the Sydney and South Coast regions (Tindall et al. 2004). Investigation of the vegetation mapping in relation to the project area found that three woodland / forest vegetation communities were mapped as occurring within the project area. In addition, non-native/non-vegetated areas were also mapped. A summary of the relevant regional community descriptions is provided below (adopted from Tindall et al. 2004).

Tableland Grassy Box – Gum Woodland

Tableland Grassy Box Gum Woodland is characterised by the presence of yellow box (*Eucalyptus melliodora*), broad-leaved peppermint (*E. dives*) and red stringybark (*E. macrorhyncha*). The sparse shrub layer is dominated by peach heath (*Lissanthe strigosa*) and urn heath (*Melichrus urceolatus*). The groundlayer is predominately grassy, with principal species including *Lomandra filiformis* subsp *coriacea,* kangaroo grass (*Themeda australis*)*,* weeping grass (*Microlaena stipoides* var. *stipoides*)*, Gonocarpus tetragynus, Hydrocotyle laxiflora,* snow grass (*Poa sieberiana*)*,* wallaby grass (*Austrodanthonia racemosa*) and *Goodenia hederacea* (Tindall et al. 2004).

The community occurs on loamy soils on undulating tablelands between 650 metres and 900 metres above sea level, with approximately 17,800 hectares of this community remaining in the region, being about 10-25% of its former occurrence. None of this community occurs within conservation reserves (Tindall et al. 2004).

Tableland Low Woodland

Tableland Low Woodland is dominated by western scribbly gum (*Eucalyptus rossii*) and brittle gum (*E. mannifera* subsp. *mannifera*). The understorey is open, however characteristic sclerophyllous shrub species include *Brachyloma daphnoides,* narrow-leaved geebung (*Persoonia linearis*)*, Hibbertia obtusifolia,* black she-oak (*Allocasuarina littoralis*) and urn heath (*Melichrus urceolatus*). The ground layer is dominated by a range of sedges, grasses and forbs including *Goodenia hederacea, Lepidosperma gunnii, Dianella revoluta, Lomandra obliqua, Gonocarpus tetragynus,* red-anther wallaby grass (*Joycea pallida*)*,* many-flowered mat-rush (*Lomandra multiflora*)*, L. filiformis* and *Patersonia sericea* (Tindall et al. 2004).

The community occurs on sandy loams on low ridges on the tableland, from 550 metres to 800 metres above sea level, in the Canyonleigh to Braidwood region. Approximately 36,800 hectares of this

community remains in the region, being about 40-60% of the former pre-clearing area (DIPNR 2005). This community is estimated to have about 4000 hectares occurring in conservation reserves (DIPNR 2005).

Western Tablelands Dry Forest

Western Tablelands Dry Forest comprises an open eucalypt forest dominated by red stringybark (*Eucalyptus macrorhyncha*), brittle gum (*E. mannifera* subsp. *mannifera*), western scribbly gum (*E. rossii*) and broad-leaved peppermint (*E. dives*). The open understorey of sclerophyllous shrubs includes *Hibbertia obtusifolia*, *Brachyloma daphnoides*, *Daviesia leptophylla* and *Stypandra glauca*. The open ground layer is composed of sedges and forbs including *Goodenia hederacea,* pomax (*Pomax umbellata*)*, Lomandra filiformis* subsp. *filiformis* and snow grass (*Poa sieberiana*) (Tindall et al. 2004).

Western Tablelands Dry Forest occurs on sandy loams on ridges of the tableland interior between 550 metres and 1150 metres above sea level, in the Wallerawang to Captains Flat region. Approximately 111,800 ha of this community remains in the region, or some 45-65% of pre-clearing levels (Tindall et al. 2004). About 23,000 hectares of this community occurs in conservation reserves (Tindall et al. 2004).

Non Native/Non Vegetated Area

Areas mapped as Non Native / Non Vegetated Area comprises modified or disturbed land. Such areas include urbanised areas or bare areas largely without native vegetation; forests, shrublands, grasslands or herbfields comprised primarily of exotic plant species, including exotic plantations and pastures. This map unit may include a variable component of native species depending on seasonal conditions and regrowth rates (Tindall et al. 2004).

3.1.2 Flora of the Project Area

3.1.2.1 Flora Species Recorded

A total of 207 flora species were recorded in the project area as a result of systematic and opportunistic surveys. Of these, 154 (74%) are indigenous to the project area, while 53 (26%) are exotic or non-local natives. A flora species list for the project area is included as **Appendix A**.

Flowering plants comprised 205 of the total number of species (monocots 83 and dicots 122), while only two ferns were recorded.

The most abundant plant families recorded were Poaceae (grasses) – 44 species; Myrtaceae (myrtles and eucalypts) – 23 species; Fabaceae (peas and wattles) 19 species; Cyperaceae (sedges) – 16 species; and Asteraceae (daisies) – 15 species.

The floristic diversity of the project area is regarded as moderate. The overall number of plant species recorded was affected by prevailing drought conditions, however, it is expected that the majority of all vascular plant species present were recorded. It is considered likely that floristic diversity is representative of similar disturbed woodlands and derived pastures occurring more widely across the Central and Southern Tablelands.

3.1.2.2 Vegetation of the Project Area

The vegetation communities in the project area have been heavily modified by past and ongoing agricultural activities which have resulted in their fragmentation and degradation. Grazing, which has been widespread across the project area, often results in modification of the species assemblage of an area.

The location of each of the vegetation communities identified within the project area is shown on **Figure 3.1**. Vegetation communities have been named in accordance with the vegetation communities mapped by Tindall et al. (2004) described in **Section 3.1.1.1**, except where the communities are not consistent with these descriptions.

Tableland Grassy Box-Gum Woodland

This vegetation community was mapped across a substantial part of the project area north of the Main Southern Railway, and covers a total of approximately 75 hectares in the Project Area. It is characterised by yellow box (*Eucalyptus melliodora*) and red stringybark (*E. macrorhyncha*). In places Blakely's red gum (*E. blakelyi*) and broad-leaved peppermint (*E. dives*) are more common, as well as blue-leaved stringybark (*E. agglomerata*) and bundy (*E. goniocalyx*). There is occasionally a sparse shrub layer, with common species including peach heath (*Lissanthe strigosa*) and urn heath (*Melichrus urceolatus*). The groundlayer is mostly grassy, with principal species including speargrass (*Austrostipa scabra*), *Lomandra filiformis* subsp *coriacea,* kangaroo grass (*Themeda australis*), weeping grass (*Microlaena stipoides* var. *stipoides*), *Gonocarpus tetragynus, Hydrocotyle laxiflora,* snow grass (*Poa sieberiana*), wallaby grass (*Austrodanthonia racemosa*) and *Goodenia hederacea*.

Tableland Low Woodland

This vegetation community covers approximately 110 hectares of the project area, being the dominant community south of the Main Southern Railway, and is also present in the northeastern sector of the project area. It occurs on poor soils usually on a rocky substrate.

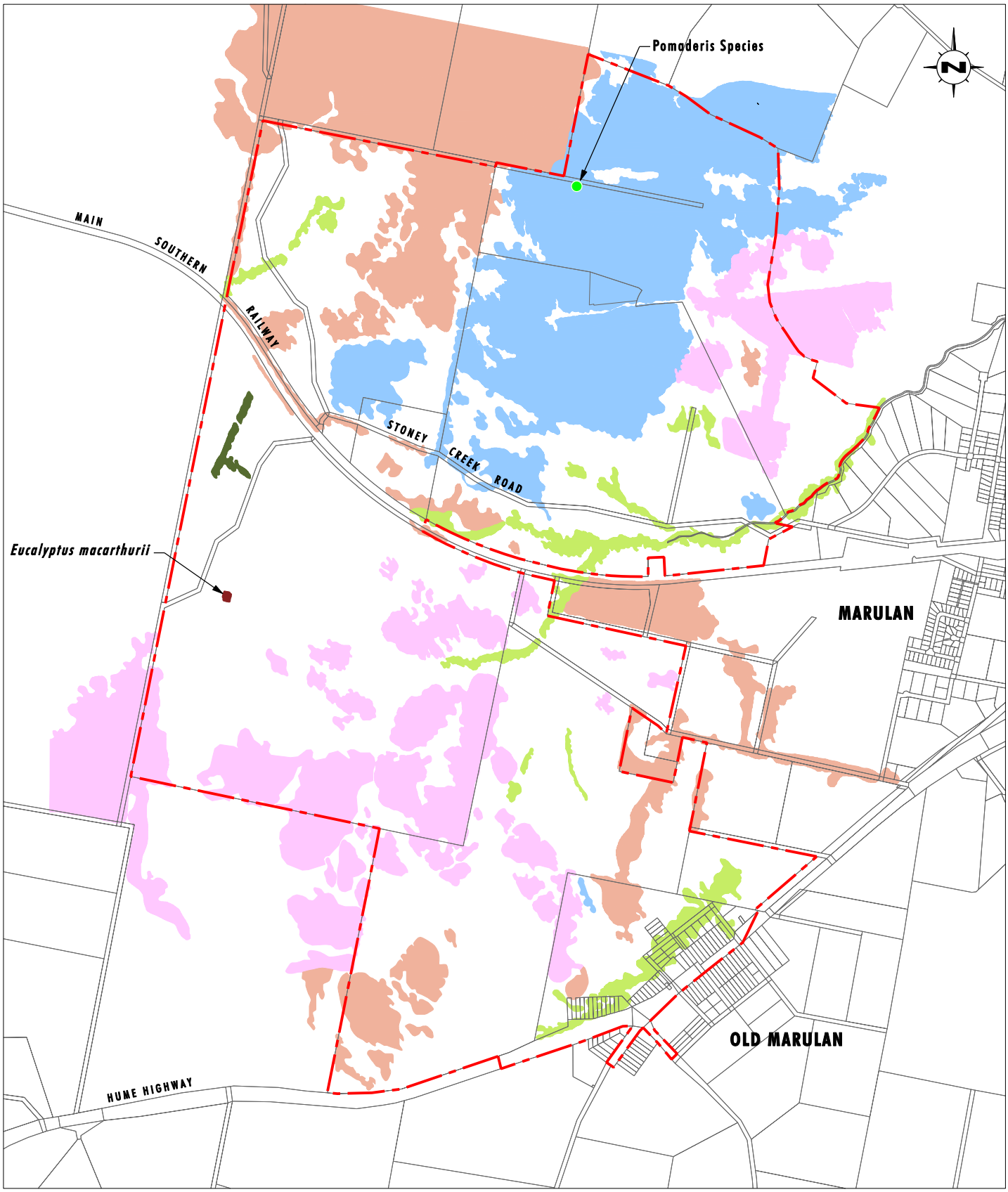
Tableland Low Woodland in the project area is dominated by western scribbly gum (*Eucalyptus rossii*). Red stringybark (*E. macrorhyncha*), blue-leaved stringybark (*E. agglomerata*), bundy (*E. goniocalyx*) and brittle gum (*E. mannifera* subsp. *mannifera*) may all be abundant, sparse or absent in areas covered by this community. The two stringybarks are often co-dominant at many sites. Black she-oak (*Allocasuarina littoralis*) formed a relatively dense mid-understorey at some sites, particularly in the remnants north of the Main Southern Railway.

The understorey is generally open through to entirely absent, however, occasionally it is moderately dense. Characteristic shrub species include *Brachyloma daphnoides,* narrow-leaved geebung (*Persoonia linearis*), *Hibbertia obtusifolia,* and urn heath (*Melichrus urceolatus*). The ground layer is typically sparse and less than 0.5 metre in height, and is dominated by a range of sedges, grasses and forbs. At many sites nodding blue-lily (*Stypandra glauca*) was very dominant, together with red-anther wallaby grass (*Joycea pallida*). Other common species included ivy goodenia (*Goodenia hederacea*), *Lepidosperma gunnii, Dianella revoluta,* twisted mat-rush (*Lomandra obliqua*), *Gonocarpus tetragynus,* many-flowered mat-rush (*Lomandra multiflora*), *L. filiformis* and *Patersonia sericea*.

Western Tablelands Dry Forest

This vegetation community, covering approximately 170 hectares, occurs primarily in the central northern part of the project area, north of the Main Southern Railway. An additional small remnant was mapped to the south near Marulan Creek. It consists of an open eucalypt forest, approximately 12-20 metres high, dominated by blue-leaved stringybark (*E. agglomerata*) with relatively few other canopy species. Kurrajong (*Brachychiton populneus* subsp. *populneus*) occurs sparsely. In places, bundy (*E. goniocalyx*), yellow box (*E. melliodora*) or red stringybark (*E. macrorhyncha*) may be moderately common. In some places a sparse through to dense mid-understorey comprising black she-oak (*Allocasuarina littoralis*) occurs, up to 10 metres in height.

An open to sparse understorey of sclerophyllous shrubs is usually present, and may include narrow-leaved geebung (*Persoonia linearis*), *Kunzea parvifolia*, *Brachyloma daphnoides*, urn heath (*Melichrus erubescens*), *Hibbertia obtusifolia* and nodding blue-lily (*Stypandra glauca*). The open



Base Source: LPI 2004

0 0.25 0.5 1.0km

Legend

- Project Area
- Unit 1 Tableland Low Woodland
- Unit 2 Western Tablelands Dry Forest
- Unit 3 Tableland Grassy Box-Gum Woodland
- Unit 4 Riparian Gum-Box-Apple Woodland
- Unit 5 Camden Woollybutt Low Open Forest
- Plantation
- Derived Pasture

FIGURE 3.1

Vegetation Communities and Significant Flora Species

ground layer consists of sedges and forbs including *Goodenia hederacea,* pomax (*Pomax umbellata*), twisted mat-rush (*Lomandra obliqua*) and weeping grass (*Microlaena stipoides* var. *stipoides*).

Riparian Gum-Box-Apple Woodland

This vegetation community is restricted in the project area to ephemeral watercourses and their narrow floodplains, and covers approximately 33 hectares of the project area. It varies considerably between the upper reaches of some creeks to the lower floodplains within the project area boundary. Typically, the upper reaches are dominated by yellow box (*Eucalyptus melliodora*), with a combination of either red stringybark (*E. macrorhyncha*), cabbage gum (*E. amplifolia* subsp. *amplifolia*), apple box (*E. bridgesiana*), Argyle apple (*E. cinerea*) or Blakely's red gum (*E. blakelyi*). These trees varied from 8 to 20 metres in height, and 5 to 40% canopy cover.

Further down the catchment these same species were often present, but usually with cabbage gum dominating. Other tree species which become locally common along the creeks included forest red gum (*E. tereticornis*) and swamp gum (*E. ovata*). Along Marulan Creek in the south of the project area, grey box (*E. moluccana*) dominates some sites. A few specimens of narrow-leaved peppermint (*Eucalyptus radiata*) were also located along Marulan Creek.

Generally, there was little or no mid-understorey present in this vegetation community, although black wattle (*Acacia decurrens*) may be locally abundant, and native cherry (*Exocarpos cupressiformis*) may occur rarely, both growing between 2 and 8 metres in height. An understorey was typically absent. In a number of places, blackberry (*[*]Rubus fruticosus* sp. aggregation) dominated in dense infestations.

The groundcover varied from being moderately dense in places (up to 80% cover), through to sparse or totally absent. It was dominated by a range of native and introduced species, although along the edges of creeklines introduced species were often dominant. During the survey periods the district suffered from a prolonged drought, resulting in the absence of much of the groundcover. Typically it was between 0.1 and 1.5 metres in height and consisted of a wide variety of species, including several grasses, sedges, forbs and lilies, depending on the presence or absence of a high water-table and in relation to soil types. Some of the more common species included: couch (*Cynodon dactylon*), three-awn wire grass (*Aristida ramosa*), wallaby grasses (*Austrodanthonia laevis* and *A. racemosa* var. *racemosa*), corkscrew grass (*Austrostipa scabra*), sheep burr (*Acaena novae-zeelandiae*), fireweed (**Senecio madagascariensis*), cat's ear (**Hypochaeris radicata*), sorrel (**Acetosella vulgaris*), soft brome (**Bromus molliformis*), squirrel tail fescue (**Vulpia bromoides*), white clover (**Trifolium repens*), *Cyperus laevis*, umbrella sedge (**Cyperus eragrostis*) and rushes (*Juncus planifolius*, *J. sarophorus* and *J. usitatus*).

In places this vegetation community bears some visual resemblance to the White Box Yellow Box Blakely's Redgum Woodland Endangered Ecological Community (EEC) listed under the TSC Act 1995, although a detailed examination of its floristic composition does not support such a classification. **Section 3.1.3** provides a comparison between the EEC and this vegetation community.

Camden Woollybutt Low Open Forest

Camden woollybutt (*Eucalyptus macarthurii*) was recorded as a monospecific dominant in an isolated approximately 0.2 hectare stand about 1 kilometre south of the Main Southern Railway (refer to **Figure 3.1**). At the time of inspection the site was devoid of other species, except for sparse grasses (*Austrodanthonia laevis*). It is likely that this species was either planted on this site, or it colonised in response to a major disturbance event. This species was recently subject to a preliminary determination under the TSC Act 1995 to be listed as a vulnerable species (refer to **Section 3.1.3**).

[*] Introduced species

Aquatic Vegetation

The project area supports very limited aquatic vegetation and where it is present it is usually very simple in terms of complexity. This vegetation was not mapped separately, due to the very limited area that it covers and the scale of the mapping; rather it is included as a component of the Riparian Gum – Box – Apple Woodland.

Most creeklines support vegetation that prefers moist or waterlogged soil. Along the edges of most semi-permanent ponds along the three major creeks (Lockyersleigh, Joarimin and Marulan), a variety of sedges, rushes and forbs were present. Common species included umbrella sedge (**Cyperus eragrostis*), *Cyperus laevis*, rushes (*Juncus planifolius*, *J. sarophorus* and *J. usitatus*) and couch (*Cynodon dactylon*).

The project area supports over 30 dams, ranging from small, steep-sided dams through to larger bodies with shallow sides. In all cases, however, the aquatic vegetation occurring within and fringing the dams was found to be very species poor, and frequently very sparsely distributed. This was most likely as a result of stock grazing, for which the dams were established, with cattle having uncontrolled access to all dams that were inspected. The most common aquatic species observed at dams included water-milfoil (*Myriophyllum variifolium*), sea celery (*Apium prostratum* subsp. *prostratum*), water ribbons (*Triglochin procerum*), ferny azolla (*Azolla pinnata*), spikerush (*Eleocharis* sp.) and duckweed (*Wolffia australiana*).

Derived Pasture

Much of the project area (approximately 630 hectares or 62%) is covered by a pasture derived from the previous clearing of forest and woodland vegetation. It varies in structure and composition depending on grazing history and the substrate on which it occurs. In general, the derived pasture is dominated by a mix of exotic and native species, although in most places where active grazing occurs exotic species dominate in terms of their cover. Common pasture species include sorrel (**Acetosella vulgaris*), dead nettle (**Lamium amplexicaule*), fireweed (**Senecio madagascariensis*), sheep burr (**Acaena novae-zeelandiae*), cat's ear (**Hypochaeris radicata*), soft brome (**Bromus molliformis*), squirrel tail fescue (**Vulpia bromoides*), white clover (**Trifolium repens*), Scotch thistle (**Onopordum acanthium*), kikuyu (**Pennisetum clandestinum*), corkscrew grass (*Austrostipa scabra*), phalaris (**Phalaris aquatica*) and wallaby grasses (*Austrodanthonia racemosa* var. *racemosa* and *A. laevis*).

3.1.3 Significant Flora and Vegetation Communities

3.1.3.1 Threatened Flora Species

No threatened flora species were recorded in the project area as a result of the survey or through investigation of databases or literature reviews. Subsequent to the completion of vegetation surveys, a preliminary determination was made by the NSW Scientific Committee to list Camden Woollybutt (*Eucalyptus macarthurii*) as a vulnerable species under the TSC Act 1995. This species was recorded in the project area.

A number of threatened flora species are known to occur in the vicinity of the project area. Several of these species are considered unlikely to occur in the project area, as potential suitable habitat is not present. A list of the threatened flora species recorded on the DEC Atlas of NSW Wildlife on the Goulburn 1:100,000 sheet and within a 10 kilometre radius of the project area on the EPBC Protected Matters Database, is included in **Table 3.1**. Also included in **Table 3.1** is an indication of the likelihood of occurrence of these species within the project area and whether assessment under Section 5A of the NSW *Environmental Planning and Assessment Act* 1979 (EP&A Act) and the Commonwealth *Environment Protection and Biodiversity Conservation Act* 1999 (EPBC Act), is required. **Table 3.1** also assesses species recorded on the Moss Vale 1:100,000 sheet that are known to occur in habitats similar to those present in the project area.

Table 3.1 – Threatened Flora Assessment

Species	Legal Status	Specific Habitat	Likely Occurrence in the Project Area
buttercup doubletail (*Diuris aequalis*)	**E** TSC Act 1995 **V** EPBC Act 1999	The species is known from fewer than 20 small and fragmented populations between Braidwood and the Blue Mountains in the Central and Southern Tablelands of NSW. *Diuris aequalis* grows among grass in sclerophyll forest and flowers from October to December (Jones 1993a).	Although not detected, it is possible that this species could occur in the project area. It is assessed in **Appendices C and D**.
tricolour orchid (*Diuris tricolor*)	**V** TSC Act 1995 **V** EPBC Act 1999	This species is a terrestrial herb with bright orange/yellow flowers speckled with red/purple and white markings (Jones 1993a). It flowers during September and November (Jones 1993a), and grows among grass in sclerophyll woodland, often with *Callitris*.	Although not detected, it is possible that this species could occur in the project area. It is assessed in **Appendices C and D**.
broad-leaved sally (*Eucalyptus aquatica*)	**V** TSC Act 1995 **V** EPBC Act 1999	*Eucalyptus aquatica* is a tree or mallee to 2 metres high with smooth bark shedding in long ribbons (Hill 2002). This species occurs in scattered areas on open swampy flats near Penrose (Hill 2002).	This species is only known to occur near Penrose, about 15 km from the project area. Although possibly suitable habitat may be present, searches of these areas did not locate the species. Based on this and the known range of the species, it is considered that it is unlikely to occur in the project area.
Pomaderris cotoneaster	**E** TSC Act 1995 **E** EPBC Act 1999	*Pomaderris cotoneaster* is an uncommon small shrub with cream flowers on short leaf panicles (Harden 2000b). It grows in dry sclerophyll forests, often on skeletal soils in the ranges south from the Moss Vale district (Harden 2000b).	Although not detected, it is possible that this species could occur in the project area. It is assessed in **Appendices C and D**.
Pomaderris delicata	**E** TSC Act 1995	*Pomaderris delicata* is confined to an area between Bungonia and Goulburn on the Southern Tablelands. The total number of plants known is about 200 (NSW NPWS 2002). Populations have been recorded in dry sclerophyll forest dominated by *Eucalyptus sieberi* with a dense shrubby understorey on shallow, rocky soil derived from Silurian and Ordovician sediments (NSW NPWS 2002).	No potential habitat is present in the project area; therefore, based on this and the known range of the species, it is considered that it is unlikely to occur.
thick-lipped spider-orchid (*Caladenia tessellata*)	**E** TSC Act 1995 **V** EPBC Act 1999	Terrestrial herb with linear leaves to 6cm (NSW NPWS 2003). Flowers Sept – Nov. Found in sheltered, moist places in forests and scrubs, especially on stony laterites on coastal tops. It is usually only seen after fire. Currently known at only two sites; Braidwood on the Southern Tablelands and Wyong on the Central Coast. The total population size is estimated to be less than 50 individuals (NSW NPWS 2003).	No potential habitat is present in the project area, therefore, based on this and the known range of the species, it is considered that it is unlikely to occur.
plumed midge-orchid (*Genoplesium plumosum*)	**E** TSC Act 1995 **E** EPBC Act 1999	This species is a terrestrial herb, 10-20 centimetres high (Jones 1993b). It flowers from December to March and flowers are green with purple stripes and a reddish purple labellum. Habitat is dry sclerophyll forest and in moss gardens over sandstone sheets. This species occurs chiefly from Port Jackson to Marulan (Jones 1993b).	Although not detected, it is possible that this species could occur in the project area. It is assessed in **Appendices C and D**.

Table 3.1 – Threatened Flora Assessment (cont)

Species	Legal Status	Specific Habitat	Likely Occurrence in the Project Area
wingless raspwort (*Haloragis exalata* subsp. *exalata*)	**V** TSC Act 1995 **V** EPBC Act 1999	This species is a rare shrub to 1.5 metres high that grows in damp places near watercourses (Wilson 2002a). This species is known from the North, Central and South Coast, and North Western Slopes of Victoria (Wilson 2002a).	Potentially suitable habitat occurs, however, based on the known range of the species, it is considered that it is unlikely to occur.
Kunzea cambagei	**V** TSC Act 1995 **V** EPBC Act 1999	This species is a prostrate or ascending shrub to 0.6 metres high. Flowers are cream to yellowish and occur in spring (Wilson 2002b). Mainly recorded from heath, and is known mainly from Mt Werong and Berrima (Wilson 2002b).	Although not detected, it is possible that this species could occur in the project area. It is assessed in **Appendices C and D**.
Thesium australe	**V** TSC Act 1995 **V** EPBC Act 1999	An erect perennial herb to 40cm, flowering spring-summer. Often prefers moist environments, typically in woodland or grassland. Range extends throughout much of NSW, however, it occurs infrequently within this range (Wiecek 1992).	Although not detected, it is possible that this species could occur in the project area. It is assessed in **Appendices C and D**.

Notes: EPBC Act 1999 = Commonwealth Environment Protection and Biodiversity Conservation Act 1999
TSC Act 1995 = NSW Threatened Species Conservation Act 1995

3.1.3.2 Regional Occurrence of Endangered Ecological Communities

Two endangered ecological communities (EECs) are known to occur within the region. Natural Temperate Grassland of the Southern Tablelands of NSW and the Australian Capital Territory is listed as an EEC under the EPBC Act, while White Box Yellow Box Blakely's Red Gum Woodland is listed as an EEC under the TSC Act.

Targeted surveys were conducted to specifically determine whether these vegetation communities were present in the project area. Surveys included general field reconnaissance to detect likely examples, followed up by specific plot-based systematic sampling. Two plots were sampled within representative stands of pasture, while a third plot was sampled in the railway corridor where a likely stand of native grassland was observed. Four plots were sampled in woodlands that comprised, at least in part, yellow box (*Eucalyptus melliodora*) or Blakely's redgum (*E. blakelyi*). The potential presence of both communities was also assessed by walking transects undertaken across the project area.

Temperate Grasslands

General Description

Natural Temperate Grassland of the Southern Tablelands of NSW and the Australian Capital Territory (DEH 2005) is dominated by moderately tall (25-50 cm) to tall (50 cm-1 m), dense to open tussock grasses with up to 70% of species being forbs. It may be treeless or contain up to 10% cover of trees, shrubs or sedges. In the Southern Tablelands, natural temperate grasslands are located at altitudes between 560 and 1200 metres above sea level in valleys influenced by cold air drainage and in broad plains. The community occurs within the geographical region of the Southern Tablelands of NSW and ACT, which extends southwards from the Abercrombie River to the Victorian Border, from Boorowa and Jindabyne to the west and Goulburn to Braidwood and Bombala to the east (DEH 2005).

The community is distinguished by the dominant cover of native tussock grasses, particularly kangaroo grass (*Themeda australis*), wallaby grasses (*Austrodanthonia* spp.) spear grasses (*Austrostipa* spp.) and tussock grasses (*Poa* spp.) (Benson 1994; Sharp 1997). About 70% of the species present are forbs, comprising mainly daisies, lilies and native legumes growing in intertussock spaces. Many of the forb species are ephemeral or annual (Costin 1954). Shrubs and trees are sparse or absent due to influences of cold air drainage, with minimum average ground temperatures often below 10 °C (Sharp 1997).

Kirkpatrick *et al.* (1995) define six broad grassland vegetation communities (each comprising one or more communities) that comprise what they term 'southeastern lowland native grasslands'. DEH (2005) refer to the ecological community of Kirkpatrick *et al.* (1995) as being Natural Temperate Grassland of the Southern Tablelands and ACT and states that it is distinguishable from other natural temperate grassland elsewhere in Australia.

The broad vegetation communities of Kirkpatrick et al. (1995) and their constituent communities are:

- communities dominated by wallaby grasses ([*Austro*]*danthonia* spp.) – 5 communities;
- communities dominated by tussock grasses (*Poa* spp.) – 6 communities;
- communities dominated by mat rushes (*Lomandra* spp.) – 1 community;
- communities dominated by spear grass ([*Austro*]*stipa* spp.) – 3 communities;
- communities dominated by porcupine grass (*Triodia* spp.) – 2 communities; and
- communities dominated by kangaroo grass (*Themeda* [*australis*]) – 12 communities.

Key attributes influencing community composition and structure are fluctuating temperature conditions, low rainfall and the low nutrient, heavy textured soils that are characterisitc of the region (Costin 1954; Groves and Lodder 1991). Natural temperate grassland integrades on the slopes with grassy woodland, which is defined as having a tree cover between 10% and 30% (Mott and Groves 1994). The community is differentiated from treeless alpine communities by species composition and position in the landscape.

Project Area and Comparison

The grassland communities in the project area are dominated primarily by a range of introduced species. In pasture that is actively grazed, key dominant species include goose grass (**Eleusine tristachya*), sorrel (**Acetosella vulgaris*), catsear (**Hypochaeris radicata*), rat's tail fescue (**Vulpia myuros*) and wire grass (*Aristida ramosa*). While a small number of the native species that are present in the EEC were identified, the community was not distinctively characterised by them.

Specific surveys for the EEC were undertaken within the railway easement, which has not been as adversely impacted by grazing practices as in the rest of the project area, to determine whether the EEC is present within the project area. The grassland sampled in the railway easement was dominated by kangaroo grass (*Themeda australis*), blue flax lily (*Dianella caerulea*), umbrella sedge (**Cyperus eragrostis*), many-flowered mat-rush (*Lomandra multiflora* subsp. *multiflora*), blackberry (**Rubus fruticosus* sp. agg), lamb's tongues (**Plantago lanceolata*), sorrel (**Acetosella vulgaris*) and mouse-ear chickweed (**Cerastium glomeratum*).

Comparisons between the dominant species present in the railway easement grassland and the derived pasture, were made with the species lists in DEH (2005) and Kirkpatrick *et al.* (1995). Both comparisons showed that the project area does not support the native grasslands as defined by DEH (2005) and listed under the EPBC Act. In particular, the grasslands present in the project area did not resemble those listed by Kirkpatrick et al. (1995), as briefly noted above.

While temperate grasslands are known to occur in the local area, this community was not identified within the project area.

White Box - Yellow Box - Blakely's Redgum Woodland

General Description

White Box Yellow Box Blakely's Red Gum Woodland is listed under Part 3 of Schedule 1 of the TSC Act as an EEC. This EEC is found on relatively fertile soils on the tablelands and western slopes of NSW and generally occurs in areas receiving rainfall between 400 and 800 mm per year extending from the western slopes, at an elevation of between 170 and 1200 metres above sea level, on the Northern Tablelands (Beadle 1981 cited in NSW NPWS 2002). The community occurs within the NSW North Coast, New England Tableland, Nandewar, Brigalow Belt South, Sydney Basin, South Eastern Highlands and South Western Slopes Bioregions. White Box Yellow Box Blakely's Red Gum Woodland includes those woodlands where the characteristic tree species usually include one or more of the following species in varying proportions and combinations: white box (*Eucalyptus albens*), yellow box (*E. melliodora*) or Blakely's red gum (*E. blakelyi*). Particular species of grass and herbs generally characterise the ground layer. In some locations, the tree canopy may be absent as a result of past clearing or thinning and at these locations only an understorey may be present. Shrubs are generally sparse or absent, though they may be locally common (NSW NPWS 2002).

Project Area and Comparison

In total, 25 (26%) of the 95 species listed by the determination were recorded in the project area. Eucalypt species present that are listed in the final determination are Blakely's redgum (*E. blakelyi*), apple box (*E. bridgesiana*), bundy (*E. goniocalyx*) and yellow box (*E. melliodora*), however, not all of these occur in association with each other. Instead, they mostly occur as minor or sometimes important

associates with other eucalypt species. Although the project area supports sites where yellow box (*E. melliodora*) is common, these sites only rarely coincide with the presence of Blakely's red gum (*E. blakelyi*), which is uncommon, and never with white box (*E. albens*), which is absent from the project area.

In summary, the White Box Yellow Box Blakely's Red Gum Woodland EEC is not considered to be present in the project area.

3.1.3.3 Regionally Significant Flora and Vegetation

Within the region, a total of 64 flora species have been identified as of regional conservation importance. These species are recognised as such because of their rarity, threats, limited distribution, or other ecological characteristics (Fallding 2002). DEC prepared a *Planning Framework for Natural Ecosystems of the ACT and NSW Southern Tablelands* (Fallding 2002) to present regional scale information on natural ecosystems and biodiversity to provide a decision making context. The *Planning Framework for Natural Ecosystems* presents regional-scale information on natural ecosystems and biodiversity. It identifies important species and ecological communities at the regional scale and accesses databases which cross jurisdictional boundaries. Important regional issues for the conservation of natural ecosystems are also identified. The landscape unit in which the project area lies is the Marulan Landscape Unit (Fallding, 2002). Fallding 2002 also contains planning and management guidelines for the Marulan Landscape Unit, within which the following species were identified as being regionally important species and communities:

- cotoneaster pomaderris;
- Tallong midge orchid;
- Molyneaux's grevillea;
- hoary sunray (white form);
- Mongarlowe mallee;
- Michelago parrot-pea;
- golden moth's orchid;
- buttercup doubletails;
- Windellama bossiaea;
- Natural Temperate Grasslands;
- White box – Yellow box – Blakeley's Red Gum Woodland.

Regional Significance of Vegetation Communities

DEC prepared a *Planning Framework for Natural Ecosystems of the ACT and NSW Southern Tablelands* (Fallding 2002) to present regional scale information on natural ecosystems and biodiversity to provide a decision making context. The *Planning Framework for Natural Ecosystems* presents regional-scale information on natural ecosystems and biodiversity. It identifies important species and ecological communities at the regional scale and accesses databases which cross

jurisdictional boundaries. Important regional issues for the conservation of natural ecosystems are also identified.

The majority of the project area has been identified as Planning Setting C which is described as an area of uncertain importance for biodiversity conservation – more investigation required (NSW NPWS 2003). As a result, DEC consider that more adequate field survey is required prior to making development decisions. Areas described as Planning Setting C are considered to potentially have threatened species and contain important areas for rehabilitation to maintain connectivity of natural ecosystems. This planning setting aims to limit further fragmentation of natural ecosystems, minimise impacts on adjacent areas of conservation importance, and to design development to maintain and enhance biodiversity values.

Based on the Tindall et al. (2004) draft vegetation mapping the conservation significance of the vegetation communities identified within the project area have been assessed. **Table 3.2** indicates the significance of each vegetation community.

Table 3.2 - Regional Extent and Reservation of Native Vegetation Communities

Vegetation Community	Pre-clearing Area (ha)[1]	Extant Area (ha)[1]	Extant Area (%)[1]	Area Regionally Reserved (ha)
Tableland Low Woodland	68,700	36,800	40-60	4,000 (5.8%)[1]
Western Tablelands Dry Forest	202,000	111,800	45-65	23,000 (11.4%)[1]
Tableland Grassy Box-Gum Woodland	111,000	17,800	10-25	0 (0%)
Riparian Gum-Apple Woodland	unknown	unknown	low[2]	small[2]
Camden Woollybutt Woodland	unknown	unknown	unknown	small[2]

Notes: [1] DIPNR (2005)
[2] Authors' estimate

3.1.3.4 Other Significant Flora Species

As a result of the flora survey, two flora species regarded to be of botanical significance were detected.

Camden Woollybutt (*Eucalyptus macarthurii*)

Camden woollybutt (*Eucalyptus macarthurii*) was recorded in an isolated stand about 1 kilometre south of the Main Southern Railway (refer to **Figure 3.1**). It is described by Hill (2002) as a tree to 40 metres high that is locally frequent ranging between the Boyd Plateau to Paddys River on the Central Tablelands. Hill (2002) notes that it grows in 'grassy woodland on relatively fertile soils on broad cold flats..' In the one stand where it was identified, Camden woollybutt was growing across an area of 0.18 hectares that was surrounded entirely by derived pasture. The site is exposed to westerly winds which, during winter in particular, are frequently strong and cold. This species dominates this area to the exclusion of all other tree species, and there is virtually no groundcover present. Initially it was considered likely that the stand was a small plantation, but it is possible that it has established in response to a major disturbance event and colonised or recolonised the site. Either way it appears likely that it is present because of human intervention. Trees on the site were generally between 4 and 8 metres in height, and thus probably less than 20-30 years of age.

Camden woollybutt is listed on the Rare or Threatened Australian Plants (ROTAP) database as 2RCi (Briggs and Leigh 1996). This indicates that it is regarded as having a range of over 200 kilometres, is considered to be rare, and is inadequately conserved within conservation reserves (Briggs and Leigh 1996).

On 22 April 2005, the NSW Scientific Committee made a preliminary determination to list this species as vulnerable under the TSC Act. The public exhibition period is proposed to finish on 17 June 2005, after which the NSW Scientific Committee is likely to determine whether or not the species should be listed.

Pomaderris lanigera - P. intermedia/andromedifolia

A site in the northern extremity of the project area supports a small population of what may be an undescribed species. Collected specimens were identified by Neville Walsh at the National Herbarium of Victoria as most likely being *Pomaderris lanigera - P. intermedia/andromedifolia*. Mr Walsh also indicated, however, that there is a chance that the specimen could represent a new as yet undescribed species.

Approximately 10 individuals of the taxon were recorded in the vicinity of Site 24 (refer to **Figure 3.1**). It was not identified at any other location in the project area (*P. intermedia* was, however, located in several other locations), although it is probable that more individuals exist than those that were recorded.

Given the taxonomic uncertainty of the specimens, and the possibility that they represent a new species, it is considered to be a significant species.

3.1.4 Connectivity of Vegetation in Local Area and Region

The project area is located in a region that has been heavily altered and used for agricultural purposes for many years. Traditionally, much of the vegetation on private land has been cleared or underscrubbed and used for grazing sheep and cattle. Such practices have led to the remaining vegetation remnants being highly disturbed and fragmented.

On a regional scale, there are a number of large conservation reserves nearby, including Morton National Park, Tarlo River National Park and Bungonia State Conservation Area. Such areas form large patches of native vegetation in a relatively disturbed agricultural landscape and provide habitat refuges and connectivity for dispersing species. Connectivity to and from these conservation reserves is patchy due to the variety of land tenures and long history of land modification. A number of State Forests and plantations add to the vegetated connectivity of the area, however, the corridor value is somewhat decreased due to management regimes and decreased habitat quality.

On a local scale, the project area contains a number of scattered vegetated fragments. In the northern section of the project area, these fragments are comparatively large and join to a large fragment to the north of the project area. North of the project area, this vegetation becomes scattered and the corridor potential decreases. A large patch of vegetation to the northeast is separated from the vegetation within the project area by a large area of highly scattered vegetation which would offer little by way of protective cover for dispersing fauna species. This area has also been approved for future rural-residential development and is likely to be subject to clearing in the next 5-10 years.

In the southern sections of the project area, vegetation fragments are generally smaller than in the north, and they form a “stepping-stone” corridor for fauna that can readily move across large gaps of open country. Potential may exist for fauna movement south from the project area, through a similarly fragmented landscape and into a large area of vegetation to the southwest, however, the Hume Highway provides a barrier to movement of some fauna species in this direction.

In general, fauna movement through the project area would be most suitable for large mobile animals such as macropods. The small, close patches of vegetation may provide cover for small birds when dispersing, however, success for this group would be limited by the distance between these fragments, and the habitat provided within each. It is unlikely that the landscape is suitable to the successful large-scale dispersal of small terrestrial mammals such as *Antechinus* spp.

3.2 FAUNA

3.2.1 Fauna Habitat of the Region

While it appears that there are no studies regarding fauna habitat which cover the region, the provision of such features at a regional level can be broadly assessed according to vegetation type and distribution. Draft regional vegetation mapping is available in the form of the DEC and DIPNR draft vegetation maps of the Goulburn and Moss Vale 1:100,000 sheets (Tindall et al. 2004). Details of the regional vegetation types have been provided in **Section 3.1.1**. In addition to this, descriptions of the vegetation communities within the nearby conservation reserves of Morton National Park, Tarlo River National Park and Bungonia SCA were also provided in **Section 3.1.1**.

The vegetation of the region is broadly classified into Grassy Woodlands, Dry Sclerophyll Forests and Non Native/Non Vegetated areas. These groups are well represented by the vegetation of the project area, particularly in a variety of woodland types, large areas of pasture and small linear areas of riparian vegetation along creeklines. The habitat features of each of these vegetation types are described in detail below.

The impact of the proposed quarry on native fauna species will arise primarily from the direct loss of fauna habitat. The project area is located in a region that has been subject to a long history of vegetation clearing for agricultural purposes such as grazing. This has led to the current condition where the vegetation of the region is highly fragmented and disturbed. Furthermore, many such fragments consist mainly of canopy species with little diversity in the understorey. This may be due to grazing, underscrubbing or domination of particular species benefited by such disturbances.

3.2.2 Fauna Habitat of the Project Area

The assessment of terrestrial fauna habitat identified a range of habitat characteristics which contribute to the distribution, abundance and diversity of terrestrial fauna within the project area. Habitat characteristics which were assessed included:

- tree hollows;
- rocky outcrops;
- wetland, riverine and wet soak areas;
- density of shrub and ground layers;
- canopy cover;
- soil type;
- ridges and upper slopes;
- fallen logs;
- leaf litter;
- decorticating bark;
- winter flowering species; and
- stags.

An assessment of habitat quality was made, based on the relative abundance of fauna microhabitats and the provision of the above habitat characteristics. The greater the diversity and abundance of microhabitats and habitat characteristics, the greater the habitat value of the area.

Several general fauna habitats are located within the project area. Each of these broad habitat units has a range of fauna habitat characteristics which influence the fauna habitat value, and the range of species which are identified within each unit. The broad habitats were woodland, grassland, riparian and aquatic habitats.

3.2.2.1 Riparian Associations

Riparian associations within the project area have been heavily degraded as a result of the area's long history of agricultural activities. The most well developed riparian associations were identified along Joarimin and Marulan Creeks both of which contain a high proportion of mature trees and consequently have a relatively high proportion of tree hollows compared to surrounding habitats, including a small number of large hollows suitable for hollow dependant birds such as owls and other arboreal species such as gliders and the common brushtail possum (*Trichosurus vulpecula*). The high proportion of small and medium sized hollows provides habitat for a wide range of arboreal mammals and endemic bird species. The extent of riparian habitat within the project area is shown on **Figure 3.1** as riparian vegetation. The habitat also occurs along a number of tributaries in the project area, including Lockyersleigh Creek.

All of the creeklines in the project area provide a significant area of foraging habitat for microchiropteran bats, with drainage lines often providing significant flyways. Numerous species of microchiropteran bats, including three threatened species, were identified foraging along creeklines within the project area with high insect activity providing a significant foraging resource.

3.2.2.2 Woodland Associations

Woodland communities provide a wide range of fauna habitats for indigenous species. Woodlands provide habitat through the provision of suitable hollows for nesting and roosting mammal, bird and amphibian species. Woodlands also provide shelter and foraging habitat within the canopy of mature trees for arboreal and flying species. Woodland understoreys with shrub and herb layers provide habitat for lower strata birds, terrestrial mammals, reptiles and amphibians. Litter and ground cover provide habitat for small mammals, reptiles, amphibians and birds.

Tree hollows were sparsely distributed across the project area with larger hollows predominately identified in the large eucalypts along Joarimin and Marulan Creeks. Tree hollows were highly scattered in the small isolated patches of woodland in the southern portion of the project area. Hollow dependant fauna were identified across the entire project area, particularly arboreal mammal and bat species.

The canopy structure of the northern half of the project area was more diverse than the southern half with a larger range of tree ages present. In the southern half of the project area several of the small isolated patches were dominated by only a few age classes and were relatively structurally homogenous. The moderately diverse structure of the woodland across the entire project area provides habitat for upper and mid strata bird species, such as honeyeaters and thornbills, and arboreal mammal species, such as the common brushtail and common ringtail possum.

Despite the open to sparse understorey across the project area, several lower strata species were identified, such as robins, the superb fairy wren and the threatened speckled warbler. Understorey layers were sparse to moderately dense in parts in the northern half of the project area, while in the southern half of the project area understorey shrub species were predominately highly scattered to absent from the small isolated patches of woodland.

Woodland ground cover across the entire project area ranged from a moderately dense to sparse cover of grasses, sedges, herbs and forbs. In some areas litter cover dominated ground cover with no vegetation ground cover species present. The paucity of ground cover across the project area is reflected in the low number of small mammal and reptile species identified.

The spatial orientation of woodland associations in the northern half of the project area as a relatively contiguous and large patch of woodland enhances its habitat quality. Woodland associations in the southern half of the project area are restricted to relatively small and isolated patches of fauna habitat in a fragmented agricultural environment. The small size of patches reduces the number and diversity of species that each patch can support and the isolation of patches further reduces the diversity of species that may occur in each patch.

3.2.2.3 Aquatic Habitats

Aquatic habitat across the project area is limited to isolated dams and ephemeral creek-lines. Over 30 dams occurred across the project area ranging from small (approximately 10 metres in diameter) to relatively large dams (approximately 80 metres long and 25 metres wide). While the depth of individual dams was not assessed, most appeared relatively shallow and were assumed to be no deeper than 3 metres when full. Habitat within the dams across the project area was limited to the surface area of water and muddy substrate. While some dams contained emergent vegetation for amphibian and water bird species, many contained no bank-side vegetation at all. Some dams contained shallow areas for foraging water birds but most had banks with relatively steep grades. Submerged log cover and islands were absent from all surveyed dams across the project area. The dams across the project area provide suitable habitat for common duck species and grebes in the larger better water quality dams, and the long-necked tortoise (*Chelodina longicollis*).

Joarimin, Marulan and Lockyersleigh Creeks and the small tributaries that drain them provide ephemeral creek habitat within the project area. During September 2004 Joarimin Creek was limited to scattered shallow pools with surrounding sedge, rush and forb vegetation. When water does flow through Joarimin and Marulan Creeks it is expected to provide areas of still water (pools) and areas of flowing water (riffles). During such times small native fish species (e.g. galaxids) may occur within the project area. Joarimin Creek provides suitable habitat for common duck species, some foraging water birds, and the long-necked tortoise. Several reptile species are likely to occur along the bank-side vegetation of the creeks, particularly during flowing periods when amphibian species are likely to be more abundant. Deep gully erosion in Marulan Creek limits the extent of aquatic vegetation which therefore reduces the extent and quality of habitat for reptile, bird and amphibian species.

3.2.3 Fauna Survey Results

A total of 111 fauna species, including five threatened species, were recorded over the three survey periods. In spring 2003, survey effort was limited to the northern central and northwestern woodland areas above and including Joarimin Creek. During July and September 2004 the northeastern portion of the project area and all areas south of the Main Southern Railway were surveyed. A detailed summary of the results is provided below, and **Appendix B** lists all fauna species recorded in the project area.

3.2.3.1 Birds

Spring 2003

A total of 44 species of birds were identified in the northern portion of the project area during surveys conducted in November 2003. The most commonly recorded species were the eastern rosella (*Platycercus eximius*), noisy miner (*Manorina melanocephala*), crimson rosella (*Platycercus elegans*) and the Australian magpie (*Gymnorhina tibicen*). The presence of the noisy miner is likely to have decreased the diversity of birds in many areas, especially passerines.

Four waterbirds, with the Australian wood duck (*Chenonetta jubata*) the most commonly identified species, were identified in farm dams and in areas of permanent water along Joarimin Creek. The nankeen kestrel (*Falco cenchroides*) was the only raptor species recorded during surveys, however, other raptors were expected to occur. The boobook owl (*Ninox novaeseelandiae*) and Australian owlet nightjar (*Aegotheles cristatus*) were recorded during nocturnal surveys.

The threatened speckled warbler was identified at two sites during spring 2003 (refer to **Figure 3.2**).

Winter 2004

A total of 16 species were recorded during the winter survey. The most commonly recorded species were the eastern and crimson rosella (*Platycercus eximius* and *Platycercus elegas*) which were recorded in all habitats within the project area. The yellow-rumped thornbill (*Acanthiza chrysorrhoa*) was commonly recorded in pasture/grassland.

Spring 2004

A total of 58 bird species were recorded in spring 2004. Of these 58 species, 33 were recorded in both years, including the eastern rosella (*Platycercus eximius*), grey fantail (*Rhipidura fuliginosa*), white-winged chough (*Corcorax melanorhamphos*) and white-throated treecreeper (*Corombates leucophaeus*). Twenty-six bird species were recorded for the first time in 2004, including the brown goshawk (*Accipiter fasciatus)*, scarlet robin (*Petroica multicolour*), golden whistler (*Pachycephala pectoralis*) and laughing kookaburra (*Dacelo novaeguineae*). A total of nine species were recorded in 2003, and were not re-identified in 2004, including the Australian owlet-nightjar (*Aegotheles cristatus*), pied butcherbird (*Cracticus nigrogularis*), leaden flycatcher (*Myiagra rubecula*) and the Mulga parrot (*Psephotus varius*). The threatened speckled warbler (*Pyrrholaemus sagittata*) was not re-recorded during surveys in 2004, although different areas were surveyed in 2003 and 2004. The speckled warbler (*Pyrrholaemus sagittata*) was the only threatened bird species identified during surveys of the project area.

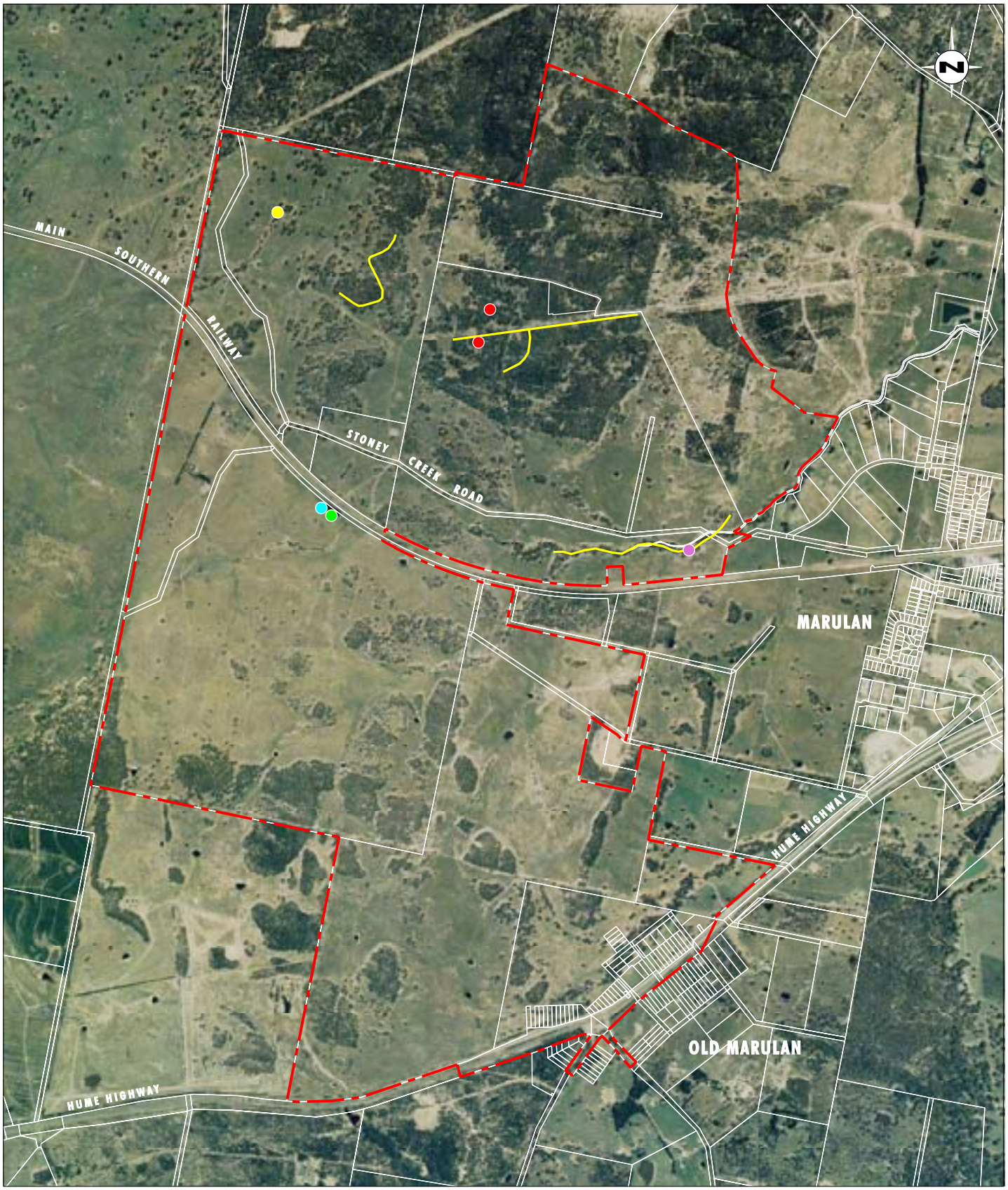
3.2.3.2 Mammals

Spring 2003

A total of 20 mammal species were recorded within the northern portion of the project area, seven of which are introduced species. The eastern grey kangaroo (*Macropus giganteus*) was recorded in moderate numbers throughout the survey period, as well as one swamp wallaby (*Wallabia bicolour*). Numerous wombat (*Vombatus ursinus*) burrows and scats were identified and this species was also recorded during spotlighting sessions across the project area. Spotlighting also identified the common brushtail possum (*Trichosurus vulpecula*), the sugar glider (*Petaurus breviceps*) and threatened squirrel glider (*Petaurus norfolcensis*). Hair samples captured in hair funnels revealed the definite occurrence of a petaurid glider, which was 'probably' a sugar glider (*Petaurus breviceps*) according to expert identification by Barbara Triggs. The hairs of the sugar and squirrel glider are generally very difficult to distinguish between and the two species are known to occur sympatrically.

Trapping results were poor during the survey with three captures per 500 trap nights (a success rate of 0.6%). The introduced black rat (**Rattus rattus*) was captured along Joarimin Creek and a common brushtail possum (*Trichosurus vulpecula*) was captured within woodland. Both captures were in cage traps. The yellow-footed antechinus (*Antechinus flavipes*) was identified through hair analysis, captured in an arboreal hair funnel.

Six microchiropteran bats were identified with the greatest density of calls recorded from Joarimin Creek and a transect in the main woodland block north of Joarimin Creek. Species recorded included Gould's wattled bat (*Chalinolobus gouldi*), large forest bat (*Vespadelus darlingtoni*) and the threatened eastern bentwing-bat (*Miniopterus schreibersii oceanensis*).



Base Source: LPI 2004, Readymix Holdings Pty Ltd (Aerial Photo March 2005)

0 0.5 1 1.25km

Legend

- Project Area
- Squirrel Glider
- Squirrel / Sugar Glider Hair Sample
- Speckled Warbler
- Eastern Freetail-bat
- Eastern False Pipistrelle
- Eastern Bentwing-bat Echolocation Record

FIGURE 3.2

Threatened Fauna Species Locations

File Name (A4): R01_V1/1829_130.dgn

The prevalence of introduced species within the project area was expected due to the high level of habitat alteration as a result of past clearing and agricultural activities and the ongoing utilisation of the project area for cattle grazing.

Winter 2004

Spotlighting undertaken during the winter survey was limited by strong winds experienced during the survey period. One sugar glider (*Petaurus breviceps*) was recorded along Marulan Creek and one common wombat (*Vombatus ursinus*) was recorded along Joarimin Creek. The sugar glider (*P. breviceps*) was recorded in both the southern portion of the project area and the northeast of the project area through hair funnel analysis. Hair funnel analysis also recorded a species of *Trichosurus*, which is presumed to be the common brushtail possum (*Trichosurus vulpeula*) which occurs widely across the project area.

Spring 2004

The spring surveys in 2004 resulted in the identification of a total of 17 mammal species within the project area. This included new records of the brown antechinus (*Antechinus stuartii*) and the common ringtail possum (*Pseudocheirus peregrinus*). Notably, the 2004 surveys resulted in new records of the threatened bat species eastern freetail-bat (*Mormopterus norfolkensis*) and eastern false pipistrelle (*Falsistrellus tasmaniensis*). Bat echolocation calls are identified on a scale of confidence ranging from a 'confident' to 'possible' identification. Both the eastern freetail-bat and eastern false pipistrelle were listed as 'possible' identifications. Although surveys targeted different areas, the 2004 surveys did not re-identify the 2003 record of the squirrel glider (*Petaurus norfolcensis*) or the eastern bentwing-bat.

3.2.3.3 Herpetofauna

Spring 2003

Three species of amphibians and six species of reptiles were recorded during fauna surveys in the northern portion of the project area. Amphibian species included *Litoria fallax, Lymnodynastes tasmaniensis* and *Litoria peronii* which were identified in both farm dams and natural watercourses of Joarimin Creek. It was expected that the project area provides habitat for further species.

The bearded dragon (*Pogona barbata*) and blue tongue lizard (*Tiliqua scincoides*) were each recorded within woodland habitat of the project area. White's skink (*Egernia whitii*) and the land mullet (*Egernia major*) were recorded along Joarimin Creek, and the red-bellied black snake (*Pseudechis porphyriacus*) was recorded in open grassland. The species recorded were found in low densities and the availability of habitat suggests that further species are likely to occur within the project area.

Winter 2004

There were no reptile or amphibian species recorded during the winter survey.

Spring 2004

Surveys in 2004 identified three additional frog species, making a total of six species recorded within the project area. These additional species included *Crinia parasignifera, Crinia signifera* and *Uperoleia laevigata*. The three species recorded in the 2003 surveys were not re-recorded in 2004.

Reptile searches identified only two species, both being recorded in the project area for the first time in 2004. These were *Ctenotus taeniolatus* and *Lampropholis guichenoti*. None of the six previously recorded reptile species were re-recorded in 2004. Weather conditions for reptile species were less than ideal with cold and very windy days and nights.

3.2.4 Threatened Fauna Species

A total of five threatened fauna species were recorded during surveys of the project area. During 2003 surveys of the northern portion of the project area, the squirrel glider (*Petaurus norfolcensis*) was identified along the southerly flowing drainage line in the northwest of the project area, with four individuals including a juvenile recorded. This species was also tentatively recorded along Joarimin Creek. The speckled warbler (*Pyrrholaemus sagittata*) was recorded in the large vegetation fragment in the northeastern corner of the project area. The eastern bentwing-bat (*Miniopterus schreibersii oceanensis*) was recorded foraging along Joarimin Creek, at one of the larger dams within 100 metres of the Main Southern Railway and in two locations in blue-leaved stringybark (*Eucalyptus agglomerata*) dominated woodland. During the 2004 surveys, the eastern freetail bat and eastern false pipistrelle were both identified at one of the larger dams within 100 metres of the railway. The location of threatened species recorded during fauna surveys is shown on **Figure 3.2**.

A number of additional threatened fauna species are known to occur in the vicinity of the project area. Several of these species are considered unlikely to occur in the project area, as potential habitat for these species is generally limited. A list of the threatened fauna species recorded on the DEC Atlas of NSW Wildlife on the Goulburn 1:100,000 map sheet and those recorded within a 10 kilometre radius of the project area on the EPBC Protected Matters Database, is included in **Table 3.3**. The table also provides an indication of their likelihood of occurrence within the project area and whether assessment under Section 5A of the EP&A Act and the EPBC Act is required. The squirrel glider (*Petaurus norfolcensis*) was recorded in the project area but was not recorded on the DEC Atlas of NSW Wildlife or in conservation reserves in the region (DEC website). The species is, however, included on the DEC list of regionally significant species for the Marulan Landscape Unit (Fallding 2002).

Table 3.3 – Threatened Fauna Assessment

Species	Legal Status	Specific Habitat	Potential to Occur
Littlejohn's treefrog *Litoria littlejohni*	**V** (EPBC Act 1999) **V** (TSC Act 1995)	A tree foraging species, but also forages on ground. May shelter from heat under rocks in high ridges in summer. Prefers wet forest margins for breeding. This species occurs along the eastern slopes of the Great Dividing Range from Watagan State Forest near Wyong, south to Buchan in northeastern Victoria. It has not been recorded in coastal habitats (NSW NPWS 2004a).	The lack of wet forest margins will prevent this species from occurring within the project area. No further assessment is required.
giant burrowing frog *Heleioporus australiacus*	**V** (EPBC Act 1999) **V** (TSC Act 1995)	A large frog to 90mm restricted to Hawkesbury Sandstone (Robinson 1993) occurring from SE NSW to VIC (NSW NPWS 2001a). In the southern population, records from Narooma, Bega, Bombala and eastern Victoria appear to be associated with Devonian igneous and sedimentary formations and Ordovician metamorphics and are generally from more heavily timbered areas. Prefers woodland and heath in sandstone ridgetop habitat and broader upland valleys. In particular it is found in small headwater creek lines and slow flowing/intermittent creek lines (NSW NPWS 2001a). This species has a generalist diet, primarily feeding on invertebrates (NSW NPWS 2001a).	The project area provides potential habitat for this species. Further assessment is provided in **Appendices C and D**.
green and golden bell frog *Litoria aurea*	**V** (EPBC Act 1999) **E** (TSC Act 1995)	The green and golden bell frog occurs in eastern and southeastern NSW to far eastern Victoria, largely at low altitudes (Cogger 2000). Once widespread, it is now restricted to isolated coastal populations, and occurs among vegetation in permanent water bodies such as streams, swamps, lagoons, dams and ponds (Cogger 2000), particularly where bullrush (*Typha* spp.) and spikerush (*Elaeocharis* spp.) occur (NSW NPWS 1999r). Green and golden bell frogs are known to occur in degraded water bodies such as brick-pits and industrial sites (NSW NPWS 1999r). Breeding occurs in summer and tadpoles feed on vegetation including algae, while adults forage for insects and other frogs (NSW NPWS 1999r). This species is known to be cannibalistic (Cogger 2000).	The ephemeral drainage lines and permanent farm dams do not provide potential habitat for this species. Dams lack emergent vegetation and habitats suitable for this species to occur. Further assessment is not required.
Rosenberg's goanna *Varanus rosenbergi*	**V** (TSC Act 1995)	This large Goanna grows to around 1 metre, occurring in the far south of Western and South Australia. Isolated populations occur in Victoria and coastal NSW (Cogger 2000). This species is commonly found in coastal heath, humid woodland and wet and dry sclerophyll forest (Cogger 2000). It shelters in burrows, hollows and rock crevices.	The site provides potential habitat for this species in the form of dry sclerophyll woodland. Further assessment is provided in **Appendix C**.
striped legless lizard *Delma impar*	**V** (TSC Act 1995) V (EPBC Act 1999)	The Striped legless lizard occurs in extreme southeastern SA, VIC and southeastern NSW, west of the Great Dividing Range (Cogger 2000). A few individuals have been found near Goulburn (Zoos Victoria 2004), NSW, and there may be an isolated population in the Hunter Valley (Swan 1990). The preferred habitat of this species is lowland native grasslands dominated by tussock forming grass species (Nunan 2004). This species is nocturnal (Swan 1990), feeding on a diet of insects including crickets, moth larvae and spiders (Nunan 2004). Breeding occurs in spring to early summer.	The project area provides potential habitat for this species. Further assessment is provided in **Appendices C and D**.

Table 3.3 – Threatened Fauna Assessment (cont)

Species	Legal Status	Specific Habitat	Potential to Occur
Australasian bittern *Botaurus poiciloptilus*	**V** (TSC Act 1995)	This Bittern has a recorded distribution from southern QLD to TAS and across NSW and VIC to eastern SA (NSW NPWS 1999b). There is an isolated population in WA (Garnett & Crowley 2000). In NSW, this species is recorded along the coast, as well as wetlands of the Murrumbidgee and Lachlan Rivers. It is frequently recorded in the Murray-Darling Basin (NSW NPWS 1999b). This species prefers shallow, brackish or freshwater swamps with dense vegetation (Garnett & Crowley 2000). Will also use dense saltmarsh vegetation in estuaries and flooded grasslands (NSW NPWS 1999b). Roosts by day, in dense reeds on the ground. Pairs occupy territories (Garnett & Crowley 2000).	The lack of suitable wetland vegetation indicates that this species is unlikely to occur within the project area. Further assessment is not required.
blue-billed duck *Oxyura australis*	**V** (TSC Act 1995)	The Blue-billed duck has a distribution ranging across southwestern and southeastern Australia, particularly in the Murray-Darling Basin and southern Victoria (Garnett & Crowley 2000). Habitat includes temperate wetlands (fresh to saline), as well as sewerage ponds, rivers, salt lakes and salt pans (Garnett & Crowley 2000). They favour deep, permanent well vegetated freshwater swamps, particularly with cumbungi beds (NSW NPWS 1999c). Young, non-breeding ducks form large nomadic flocks, particularly in autumn and winter (NSW NPWS 1999c). Nesting occurs in dense vegetation (NSW NPWS 1999c).	The project area provides potential habitat for this species. Further assessment is provided in **Appendix C**.
swift parrot *Lathamus discolor*	**E** (TSC Act 1995) **E** (EPBC Act 1999)	The swift parrot breeds in Tasmania, migrating to the mainland in May to August, where it forages on flowering eucalypts mainly in Victoria and NSW (Swift Parrot Recovery Team 2001). In NSW, it has been recorded from the western slopes region along the inland slopes of the Great Dividing Range, as well as forests along the coastal plains from southern to northern NSW (Swift Parrot Recovery Team 2001). This species often visit box-ironbark forests, feeding on nectar and lerp (Garnett & Crowley 2000). In NSW, typical feed species include mugga ironbark, grey box, swamp mahogany, spotted gum, red bloodwood, narrow-leaved red ironbark, forest red gum and yellow box (Swift Parrot Recovery Team 2001). Of such species, larger trees bearing more flowers are selected.	The project area provides potential habitat for this species. Further assessment is provided in **Appendices C and D**.
eastern ground parrot *Pezoporus wallicus wallicus*	**V** (TSC Act 1995)	The Eastern ground parrot inhabits low heathland and sedgeland (Garnet and Crowley 2000), swampy areas, drier ridges and nearby grasslands (Pizzey and Knight 1997). A nest is formed on the ground from bitten off stems (Pizzey and Knight 1997) in dense vegetation (Garnet and Crowley 2000). The Eastern ground parrot is a grainivore, eating seeds from a range of herbs and heath species (Garnet and Crowley 2000). Requires a habitat with a mosaic of burning patterns to ensure sufficient foraging resources. Breeding occurs from September to December.	The lack of suitable habitats within the project area prevents this species from occurring. Further assessment is not required.

Table 3.3 – Threatened Fauna Assessment (cont)

Species	Legal Status	Specific Habitat	Potential to Occur
barking owl *Ninox connivens*	**V** (TSC Act 1995)	The barking owl is distributed sparsely throughout temperate and semi-arid areas of mainland Australia, however, it is most abundant in the tropical north (Kavanagh 2002a). Most records for this species occur west of the Great Dividing Range (Kavanagh 2004). Habitat for this species includes dry forests and woodlands (Kavanagh 2002a), often in association with hydrological features such as rivers and swamps (Taylor et al. 2002). Taylor *et al.* (2002) reports that not enough data has been collected to accurately estimate home range sizes, however, one has been radio-tracked over 226 ha. Large hollows are required for breeding. Barking owls are strictly seasonal breeders, laying in late winter or spring (NSW NPWS 2003). The species has a broad diet dominated by ground-dwelling mammals, birds and insects (Kavanagh 2002b).	The habitats of the project area are not considered likely to support the barking owl. The project area may however, form part of an extensive home range. Further assessment is provided in **Appendix C**.
masked owl *Tyto novaehollandiae*	**V** (TSC Act 1995)	The masked owl occurs sparsely throughout the continent and nearby islands, including Tasmania and New Guinea (Kavanagh 2002a). This species is generally recorded from open forest habitat with sparse mid-storey but patches of dense, low ground cover. It is also recorded from ecotones between wet and dry eucalypt forest, along minor drainage lines and near boundaries between forest and cleared land (Kavanagh 2004). Home range estimates vary between 800 and 1200 hectares (Kavanagh 2002a). Masked owls nest (and roost) in large hollows of old trees. They also roost among dense foliage in variety of sub-canopy trees (Kavanagh 2004). *Tyto* species have a variable breeding season (likely to be in response to prey fluctuations), however, they are most likely to breed in autumn or winter (Kavanagh 2002a). Masked Owls commonly prey on small terrestrial and scansorial mammals, occasionally supplementing with diurnal birds (Kavanagh 2002b).	The project area may fall within the foraging range of this species, however the site is not expected to provide nesting resources. Further assessment is provided in **Appendix C**.
brown treecreeper (eastern subsp.) *Climacteris picumnus victoriae*	**V** (TSC Act 1995)	This species occurs over central NSW, west of the Great Dividing Range and sparsely scattered to the east of the Divide in drier areas such as the Cumberland Plain of Western Sydney, and in parts of the Hunter, Clarence, Richmond and Snowy River valleys (NSW Scientific Committee 2001). Typical habitat for this species includes drier forests, woodlands and scrubs with fallen branches; river red gums on watercourses and around lake-shores; paddocks with standing dead timber; and margins of denser wooded areas (Pizzey & Knight 1997). Prefers areas without dense understorey (NSW Scientific Committee 2001). Occupies permanent territories, building a nest of grass usually in tree hollow 3-10 metres or higher, or in stumps or fence posts. This species is highly sensitive to habitat fragmentation, with disrupted dispersal due to habitat isolation being the primary threat (Walters et al. 1999).	The project area provides potential habitat for this species. Further assessment is provided in **Appendix C**.

Table 3.3 – Threatened Fauna Assessment (cont)

Species	Legal Status	Specific Habitat	Potential to Occur
regent honeyeater *Xanthomyza phrygia*	**E** (EPBC Act 1999) **E** (TSC Act 1995)	The regent honeyeater has a patchy distribution across the eastern states of Australia (NSW NPWS 1999n). This semi-nomadic species generally occurs in temperate eucalypt woodlands and open forests of southeastern Australia. It is commonly recorded from box-ironbark eucalypt associations, wet lowland coastal forests dominated by swamp mahogany, spotted gum and riverine *Casuarina* woodlands (NSW NPWS 1999n). An apparent preference exists for the wettest, most fertile sites within these associations, such as creek flats, river valleys and foothills (Garnet & Crowley 2000). Breeding occurs between July and November. Known breeding sites are rare, with the most important sites being in the Warrumbungles NP, Pilliga NR, Barraba district, Gosford area, Hunter Valley and Capertee Valley (NSW NPWS 1999n).	This species was not recorded within the project area, however the presence of yellow box within the project area indicates that the site provides potential habitat for the species. Further assessment is provided in **Appendices C and D**.
hooded robin *Melanodryas cucullata cucullata*	**V** (TSC Act 1995)	This form of the hooded robin is distributed throughout southeastern Australia, from central Queensland to the Spencer Gulf, South Australia. This form occurs throughout NSW except for the northwest, where it intergrades with the northern form *M. cucullata picata* (NSW Scientific Committee 2001f). The species occupies a range of eucalypt woodlands, Acacia shrublands and open forests. In temperate woodlands, it favours open areas adjoining large woodland blocks, with areas of dead timber and sparse shrub cover (NSW Scientific Committee 2001f). In semi-arid western NSW, the species favours open woodlands of belah, rosewood, mulga and cypress. Hooded robins live in small family groups, and build cup-shaped nests. Home ranges are relatively large, and averaged 18 hectares for birds from the New England Tableland (NSW Scientific Committee 2001f). The species appears unable to survive in remnants smaller than 100-200 hectares (NSW Scientific Committee 2001f).	The project area contains suitable open woodland habitat for this species. Further assessment is provided in **Appendix C**.
eastern bristlebird *Dasyornis brachypterus*	**E** (EPBC Act 1999) **E** (TSC Act 1995)	The eastern bristlebird is a cover-dependent and fire-sensitive species. It inhabits a wide range of vegetation communities including rainforest, eucalypt forest, woodland, mallee, shrubland, swamp, heathland and sedgeland where there is low dense cover post-fire (Baker 1997). Eastern bristlebirds are generally detected singly or in pairs, rarely as a group of three or four and never in a flock. Individuals have a home range of more than 10 ha and are presumed to be sedentary (Baker 1998).	The lack of significant ground or shrub layers due to heavy and ongoing grazing is likely to prevent this species from occurring within the project area. The species is not likely to occur and further assessment is not required.

Table 3.3 – Threatened Fauna Assessment (cont)

Species	Legal Status	Specific Habitat	Potential to Occur
speckled warbler *Pyrrholaemus saggitata*	**V** (TSC Act 1995)	The speckled warbler has a distribution from southeastern Queensland, through central and eastern NSW to Victoria. In NSW, this species occupies eucalypt and cypress woodlands, generally on the western slopes of the Great Dividing Range. They inhabit woodlands with a grassy understorey, leaf litter and shrub cover, often on ridges or gullies (Garnett & Crowley 2000). This species has also been recorded in cypress woodlands of the northern Riverina and in drier coastal areas such as the Cumberland Plain, Western Sydney and the Hunter and Snowy River valleys (NSW Scientific Committee 2001e). The species is sedentary, living in pairs or trios and nests on the ground in grass tussocks, dense litter and fallen branches. Home ranges vary from 6-12 hectares (NSW Scientific Committee 2001). Barrett et al. (1994) found that the species decreased in abundance as woodland area decreased, and it appears to be extinct in districts where no fragments larger than 100 hectares remain.	This species was recorded during fauna survey conducted within the project area. Further assessment is provided in **Appendix C**.
olive whistler *Pachycephala olivacea*	**V** (TSC Act 1995)	The olive whistler occurs along the east coast of Australia from southeastern QLD to Tasmania. It typically occurs in alpine thickets, wetter rainforests/forests/woodlands, along vegetated watercourses, coastal tea tree/paperbark scrubs and heaths (Pizzey & Knight 1997). Breeding occurs Sept-Jan, in a cup-shaped nest of twigs, bark and leaves.	The habitats of the project area do not conform to the habitat preferences of this species. Further assessment is not required.
diamond firetail *Stagonopleura guttata*	**V** (TSC Act 1995)	The diamond firetail occurs through central and eastern NSW, north into southern and central Queensland and south through Victoria to South Australia. In NSW, it mainly occurs west of the Great Dividing Range, although populations are known from drier coastal areas such as the Cumberland Plain and the Hunter, Clarence, Richmond and Snowy River valleys (NSW Scientific Committee 2001b). Habitat includes a range of eucalypt dominated communities with a grassy understorey, including woodland, forest and mallee (Garnett & Crowley 2000). It appears that populations are unable to persist in areas where there are no vegetated remnants larger than 200 hectares (NSW Scientific Committee 2001b).	The project area provides potential habitat for this species. Further assessment is provided in **Appendix C**.

Table 3.3 – Threatened Fauna Assessment (cont)

Species	Legal Status	Specific Habitat	Potential to Occur
spotted-tailed quoll *Dasyurus maculatus*	**E** (EPBC Act 1999) **V** (TSC Act 1995)	In NSW, the spotted-tailed quoll occurs on both sides of the Great Dividing Range, with highest densities occurring in the northeast of the state. It occurs from the coast to the snowline and inland to the Murray River (Edgar & Belcher 2002). A separate subspecies (*gracilis*) exists in northern Queensland (NSW NPWS 1999g). Habitat for this species is highly varied, ranging from sclerophyll forest, woodlands, coastal heathlands and rainforests. Records exist from open country, grazing lands and rocky outcrops (NSW NPWS 1999g). Suitable den sites including hollow logs, tree hollows, rocky outcrops or caves are necessary (NSW NPWS 1999g). Home range estimates for this highly mobile species vary between 800 hectares and 20 km^2. These home ranges are often defined by a number of 'latrines' (Edgar & Belcher 2002) which are often in exposed areas such as rocky outcrops. Breeding occurs generally between April and July (Edgar & Belcher 2002). This species feeds on a variety of species, ranging in size from small wallabies to insects and carrion (Edgar & Belcher 2002).	The project area occurs adjacent to extensive tracts of vegetation large enough to support a spotted-tailed quoll. While no evidence of the species presence within the project area was noted, the area may form part of the foraging range for this species. Further assessment is provided in **Appendices C and D**.
southern brown bandicoot *Isoodon obesulus obesulus*	**E** (EPBC Act 1999) **E** (TSC Act 1995)	This species is a small marsupial which feeds on insects and their larvae, worms, berries, small vertebrates (Cronin 1996), fungi and other subterranean plant material (Strahan 1995). The male home range is 7 hectares, while that of the female is 2 hectares (Strahan 1995). The species breeds in winter, continuing until summer (Cronin 1996). It requires habitats where there is a mosaic of post-fire vegetation (NSW NPWS 1999i). This creates areas with low ground cover, supporting an abundance of insects. The species is restricted to areas around Sydney and the far southeast of NSW. It has most frequently been recorded near Eden (NSW NPWS 1999i).	The habitats preferred by this species were not recorded within the project area and the species is not expected to occur. Further assessment of this species is not required.
koala *Phascolarctos cinereus*	**V** (TSC Act 1995)	The koala has a fragmented distribution throughout eastern Australia, with the majority of records from NSW occurring on the central and north coasts, as well as some areas further west (NSW NPWS 1999h). It is known to occur along inland rivers on the western side of the Great Dividing Range (NSW NPWS 1999h). This species inhabits eucalypt forest and woodland, with suitability influenced by tree species and age, soil fertility, climate, rainfall and fragmentation patterns (NSW NPWS 1999h). The species is known to feed on a large number of eucalypt and non-eucalypt species, however it tends to specialise on a small number in different areas (NSW NPWS 1999h). *Eucalyptus tereticornis, E. punctata, E. cypellocarpa, E. viminalis, E. microcorys, E. robusta, E. albens, E. camaldulensis* and *E populnea* are some preferred species (NSW NPWS 1999h). Home ranges vary considerably according to habitat quality, with an average of 10 to 15 hectares in the Pilliga State Forest (northwestern NSW) to an average of 80 to 90 hectares on the NSW lower North Coast at Port Stephens (NSW NPWS 2003c). Young are generally produced in summer, remaining with the mother for up to 3 years (NSW NPWS 1999h).	Assessment under SEPP 44 has indicated that the project area does not comprise potential koala habitat. Therefore, further assessment is not required.

Table 3.3 – Threatened Fauna Assessment (cont)

Species	Legal Status	Specific Habitat	Potential to Occur
yellow-bellied glider *Petaurus australis*	**V** (TSC Act 1995)	The yellow-bellied glider has a patchy distribution across eastern and southeastern Australia, being essentially coastal in NSW and extending inland to adjacent range (NSW NPWS 2003d). The species is generally found at low population densities in habitat that is patchily distributed (NSW NPWS 2003d). Tall, mature sclerophyll forests in regions of high rainfall are the preferred habitat of this species, particularly where hollows and year-round food resources are abundant (NSW NPWS 1999h). Dens are generally leaf-lined and in hollow trunks or limbs of living smooth-barked eucalypts (NSW NPWS 1999h). The diet primarily consists of plant and insect exudates. In NSW, this species feeds on most *Eucalypt* and *Corymbia* species, with records of *Lophostemon, Acacia* and *Angophora* also being used (NSW NPWS 2003d). Triangular or 'v' shapes incisions are characteristic of feeding trees. This species has a distinct range of calls, some of which can be heard up to 400 metres away (Russell 2002). It is a highly social species, living in family groups in home ranges of approximately 35 hectares (Russell 2002). Young are born between May to September, depending on location (Russell 2002).	The project area lacks the preferred habitats of this species, which is therefore considered unlikely to occur. Further assessment is not required.
squirrel glider *Petaurus norfolcensis*	**V** (TSC Act 1995)	The squirrel glider occupies a sparse range along the east cost and immediate inland districts from western Victoria to north Queensland (NSW NPWS 1999j). It generally inhabits dry sclerophyll forest and woodland, also being recorded from coastal and wet forests in the northern parts of NSW and Queensland (Suckling 2002). Preferred foraging habitat contains a regenerating understorey of eucalypts, wattles and flowering shrubs, allowing them to feed on arboreal invertebrates, eucalypt nectar, pollen and sap, and the seeds and gum of acacia species (NSW Scientific Committee 2000). Winter flowering species such as red ironbark, spotted gum and coastal banksia are particularly important when other food sources are limited. Family groups den in tree hollows, particularly in smooth-barked species (NSW NPWS 1999j). Home ranges vary between 0.65 and 8.55 hectares (NSW NPWS 1999j), and a number of hollows will be used in rotation. Births occur throughout the year, and can vary according to food availability (NSW NPWS 1999j).	This species was recorded within the project area. Further assessment is provided in **Appendix C**.
long-nosed potoroo (SE Mainland) *Potorous tridactylus*	**V** (TSC Act 1995) **V** (EPBC Act 1999)	Occupies a variety of habitats from coastal heath to dry or wet sclerophyll forest, its range extending from southeast Queensland to Tasmania. Restricted to areas with rainfall greater than 760mm per annum (Strahan 1995) and prefer habitats with a dense ground cover and light, sandy soils. Feeds on fungi, seeds, arthropods, fleshy fruits, leaves roots and tubers. Known predators include the fox and dingo and may include wild dogs (Griffiths 2002). This species has two breeding seasons: end of winter/early spring and late summer (Griffiths 2002).	The project area lacks the dense ground cover required by this species. The species is not expected to occur and further assessment is therefore not required.

Table 3.3 – Threatened Fauna Assessment (cont)

Species	Legal Status	Specific Habitat	Potential to Occur
brush-tailed rock-wallaby *Petrogale penicillata*	**V** (EPBC Act 1999) **E** (TSC Act 1995)	Populations of this species are scattered along the coast and ranges from the QLD border to the south coast. They occur in rocky sites with a grassy understorey in sclerophyll forests, rainforest and open woodland. Prefers sites with a northerly aspect (Strahan 1995). This species tend to occur in small colonies, of 6-10 individuals. They shelter in caves, rocky crevices and dense stands of lantana during the day. Feeds on grasses, forbs, seasonal fruits and seeds and the foliage of trees and shrubs (NSW NPWS 2004h).	The brush-tailed rock wallaby is unlikely to occur within the project area due to a lack of suitable habitats. Further assessment is not required.
grey-headed flying-fox *Pteropus poliocephalus*	**V** (TSC Act 1995) **V** (EPBC Act 1999)	This species has been recorded along the eastern coastal plain from Bundaberg in Queensland, through NSW and south to eastern Victoria. They have been recorded from Melbourne, some occurring west to Warnambool (NSW NPWS 2004g). Regular movements are made over the Great Dividing Range to the western slopes of NSW and Queensland. The species feeds on a variety of flowering and fruiting plants, including native figs and palms, blossoms from eucalypts, angophoras, tea-trees and banksias (Tidemann 2002). It plays an important role in seed dispersal (NSW NPWS 2001). Camps sites are usually formed in gullies, usually in vegetation with a dense canopy and not far from water (Tidemann 2002). Individuals generally exhibit a high fidelity to traditional camps and return annually to give birth and rear offspring (NSW NPWS 2004g). Most births occur in September or October (Churchill 1998).	The project area provides potential habitat for this species. Further assessment is provided in **Appendices C and D**.
eastern freetail-bat *Mormopterus norfolkensis*	**V** (TSC Act 1995)	This species has a distribution along the east coast of NSW from south of Sydney north into southeast QLD, near Brisbane (Churchill 1998). Most records are from dry eucalypt forest and woodland east of the Great Dividing Range. The species has also been recorded over a rocky river in rainforest and wet sclerophyll forest (Churchill 1998). Generally only solitary animals are recorded (Allison & Hoye 2002). This species generally roosts in tree hollows, however, it has been recorded from roofs, under bark and the metal caps of telegraph poles (Churchill 1998). It generally forages above the forest canopy, over water and also on the ground.	This species was recorded within the site. Further assessment is provided in **Appendix C**.
eastern bentwing-bat *Miniopterus schreibersii oceanensis*	**V** (TSC Act 1995)	This species has an eastern distribution from Cape York along the coastal side of the Great Dividing Range and into the southern tip of South Australia (Churchill 1998). Habitat ranges widely, from rainforest, wet and dry sclerophyll forest, monsoon forest, open woodland, paperbark forests and open grasslands (Churchill 1998). It is cave-dwelling, congregating in maternity caves for breeding and later dispersing to satellite caves, generally within 300 kilometres (Churchill 1998). It hibernates over winter in southern parts of their range (Churchill 1998). They have been recorded roosting in a variety of man-made structures including buildings and culverts (Dwyer 2002b). A single young is born in December (Churchill 1998).	This species was recorded within the project area. Further assessment is provided in **Appendix C**.

Table 3.3 – Threatened Fauna Assessment (cont)

Species	Legal Status	Specific Habitat	Potential to Occur
eastern false pipistrelle *Falsistrellus tasmaniensis*	**V** (TSC Act 1995)	This species has a range from southeastern Queensland, through NSW, Victoria and into Tasmania (Churchill 1998). Habitat includes sclerophyll forest from the Great Dividing Range to the coast. They appear to prefer wet habitats, with trees over 20 metres high (Churchill 1998). They generally roost in tree hollows or trunks, in groups of 6 – 36. Occasionally recorded from caves or buildings (Churchill 1998). The species appears to hibernate over winter in southern parts (Phillips 1995). A single young is born in December (Churchill 1998).	This species was recorded within the project area. Further assessment is provided in **Appendix C**.
large-eared pied bat *Chalinolobus dwyeri*	**V** (TSC Act 1995) **V** (EPBC Act 1999)	This species has a distribution from southwestern Queensland to NSW from the coast to the western slopes of the Great Dividing Range (Churchill 1998). It is generally found in a variety of drier habitats, including dry sclerophyll forests and woodlands, however, it probably tolerates a wide range of habitats (Hoye & Dwyer 2002). The species tends to roost in the twilight zones of mines and caves, generally in colonies or common groups (Churchill 1998). Females give birth (generally to twins) in November (Churchill 1998).	The project area provides potential habitat for this species. Further assessment is provided in **Appendices C and D**.
Macquarie perch *Macquaria australasica*	**V** (FM Act 1994) **E** (EPBC Act 1999)	The Macquarie perch is reasonably abundant in the Hawkesbury/Nepean and Shoalhaven systems. They are found in both river and lake habitats, especially in the upper reaches of rivers and their tributaries. The preferred habitat is cool, shaded upland streams with deep rocky pools and substantial cover. The species will also survive well in impoundments with suitable feeder streams in which to breed.	The project area lacks deep permanent pools and the cool, shaded upland streams that provide the preferred habitat of this species. It is not expected to occur and further assessment is therefore not required.
Australian greyling *Prototroctes maraena*	**V** (EPBC Act 1999)	The Australian grayling is relatively uncommon and occurs in coastal drainages from the Grose River, NSW to the Hopkins River, Vic (Allen et al. 2002). The preferred habitat is the upper reaches of rivers in clear, moderate to fast-flowing water (Allen et al. 2002). The species is typically found in gravel-bottom pools and often forms aggregations below barriers to upstream movement (e.g. weirs and waterfalls) (Allen et al. 2002).	The project area generally lacks the clear, moderate to fast flowing water or gravel-bottom pools that provide the preferred habitat of this species. It is not expected to occur and further assessment is therefore not required.

Notes: EPBC Act 1999 = Commonwealth Environment Protection and Biodiversity Conservation Act 1999
FM Act 1994 = NSW Fisheries Management Act 1994
TSC Act 1995 = NSW Threatened Species Conservation Act 1995

3.2.5 Environment Protection and Biodiversity Conservation Act 1999 Considerations

Under the EPBC Act, approval from the Commonwealth Minister for the Environment is required for any action that may have a significant impact on matters of national environmental significance. These matters are:

- World Heritage properties;
- National Heritage Places;
- Ramsar wetlands;
- Cetaceans, migratory species, threatened species, critical habitats or ecological communities listed under the EPBC Act;
- Commonwealth land, marine areas or reserves; and
- Nuclear actions (including uranium mining).

In addition to the 16 listed threatened species outlined in **Tables 3.1** and **3.3**, five terrestrial migratory species known to occur, or considered likely to occur, on the basis of habitat modelling, within ten kilometres of the project area were identified on the EPBC Protected Matters database (7 February 2005). A number of migratory species classified as Listed Marine Species and Migratory Wetland Species were also included in the search results. Of these species, those with potential habitat in the project area are shown in **Table 3.4**.

Table 3.4 – Migratory and threatened fauna species listed under the EPBC Act potentially occurring within the project area

Scientific Name	Common Name	Classification
Lathamus discolor	swift parrot	Threatened Species Listed Marine Species
Rostratula australis	Australian painted snipe	Threatened Species
Xanthomyza phrygia	regent honeyeater	Threatened Species Migratory Terrestrial species
Heleioporus australicus	giant burrowing frog	Threatened Species
Chalinolobus dwyeri	large-eared pied bat	Threatened Species
Dasyurus maculatus maculatus	spotted-tailed quoll	Threatened Species
Pteropus poliocephalus	grey-headed flying-fox	Threatened Species
Haliaeetus leucogaster	white-bellied sea-eagle	Migratory Terrestrial species Listed Marine Species
Hirundapus caudacutus	white-throated needletail	Migratory Terrestrial species Listed Marine Species
Myiagra cyanoleuca	satin flycatcher	Migratory Terrestrial species Listed Marine Species
Rhipidura rufifrons	rufous fantail	Migratory Terrestrial species Listed Marine Species
Gallinago hardwickii	Latham's snipe	Migratory Wetland Species Listed Marine Species
Rostratula benghalensis s. lat.	painted snipe	Migratory Wetland Species Listed Marine Species

Table 3.4 – Migratory and threatened fauna species listed under the EPBC Act potentially occurring within the project area (cont)

Scientific Name	Common Name	Classification
Apus pacificus	fork-tailed swift	Listed Marine Species
Ardea alba	great egret	Listed Marine Species
Ardea ibis	cattle egret	Listed Marine Species
Merops ornatus	rainbow bee-eater	Listed Marine Species

Fauna surveys undertaken in the project area identified seven listed migratory species which are listed in **Table 3.5**.

Table 3.5 - Listed Migratory Species recorded within the Project Area

FAMILY / *Scientific Name*	**Common Name**
ACCIPITRIDAE	
Aquila audax	wedge-tailed eagle
Accipiter fasciatus	brown goshawk
ANATIDAE	
Chenonetta jubata	Australian wood duck
Anas superciliosa	Pacific black duck
Anas gracilis	grey teal
FALCONIDAE	
Falco longipennis	Australian hobby
Falco cenchroides	nankeen kestrel

The EPBC Act lists criteria which are used to determine whether an action is likely to have a significant impact on listed threatened or migratory species. These criteria are addressed in the assessment of significance provided in **Appendix D**. The results of the assessment conclude that the proposed development will not result in a significant impact on listed threatened or migratory species.

3.2.6 Regionally Significant Fauna Species

Within the region, a total of 92 fauna species have been identified as of regional conservation importance. These species are recognised as such because of their rarity, threats, limited distribution, or other ecological characteristics (Fallding 2002). Within the Planning and Management Guidelines for the Marulan Landscape Unit, the species listed in **Table 3.6** were identified as being regionally important species

Table 3.6 – Regionally Significant Fauna defined by Fallding (2002)

Species	Listed TSC Act	Recorded On Site
large-footed myotis	V	N
large-eared pied bat	V	N
Australasian bittern	V	N
glossy black-cockatoo	V	N
masked owl	V	N
powerful owl	V	N
speckled warbler	V	Y

Table 3.6 – Regionally Significant Fauna defined by Fallding (2002) (cont)

Species	Listed TSC Act	Recorded On Site
regent honeyeater	E	N
hooded robin	V	N
brush-tailed rock-wallaby	E	N
yellow-bellied glider	V	N
squirrel glider	V	Y
spotted-tailed quoll	V	N
eastern bentwing-bat	V	Y
eastern false pipistrelle	V	Y
greater broad-nosed bat	V	N
brown treecreeper	V	N
diamond firetail	V	N
black-chinned honeyeater	V	N
little whip-snake	V	N
green and golden bell frog	E	N

All of the species listed as regionally significant species in the Marulan Landscape Unit are listed as threatened species under the TSC Act or the EPBC Act. The squirrel glider, speckled warbler, eastern bentwing-bat and eastern false pipistrelle were recorded in the project area and are addressed further within **Appendix C**.

4.0 IMPACT ASSESSMENT

4.1 FLORA

In terms of general diversity of flora species, the project area appears to be reasonably representative of surrounding areas. Overall, plant species diversity is at least moderate, with a total of 207 species being recorded, of which 53 (26%) were not native to the area.

No threatened flora species or endangered populations were recorded in the project area, although one species subject to a preliminary determination, Camden Woollybutt, was recorded. It is possible that five additional threatened flora species may be present, even though they were not located during flora surveys. Despite this, an assessment under Section 5A of the EP&A Act (refer to **Appendix C**) indicates that the project is unlikely to significantly impact these species, even if they were present. An assessment of listings under the EPBC Act similarly concluded that the proposal is unlikely to significantly impact any listed species or communities (refer to **Appendix D**).

One ROTAP species was recorded in the project area, Camden Woollybutt (*Eucalyptus macarthurii*). As discussed above, this species has also been recently assessed by the NSW Scientific Committee, which has made a preliminary determination to list it as vulnerable under the TSC Act. It was recorded growing in a monoculture about 1 kilometre south of the Main Southern Railway. It is likely that it was planted at the site, or that it colonised in response to a major disturbance event, as evidenced by sub-parallel rows of trees. Most trees were between 5 and 8 metres in height, suggesting an age of less than 30 years. The proposed development would require the removal of the entire stand of this species (0.18 hectares). Although it is likely that this species was planted, and is probably not naturally occurring, it is recognised that being a ROTAP and a preliminarily determined vulnerable species it is of botanical significance. As a result, it is proposed to establish new plantings of double the current area to compensate for the loss of this species (refer to **Section 5.2.1**).

One other flora species of botanical significance was recorded in the project area. *Pomaderris lanigera - P. intermedia/andromedifolia* was identified in an area in the northern extremity of the project area. This taxon was not recorded in any other location, despite targeted searches. Expert advice suggests that this taxon could possibly constitute a new species, however further research and survey will be required to confirm or refute this (N. Walsh pers. comm. 2004). The area in which this taxon occurs is proposed to be part of a Habitat Management Area. As a result, this stand would not be affected by the project (refer to **Section 5.2.2**). It is proposed to undertake specific monitoring of the taxon, and to assist the Royal Botanic Gardens of Melbourne with their taxonomic investigation, as required.

4.2 VEGETATION COMMUNITIES

In terms of the general diversity of vegetation communities, the project area appears to be reasonably representative of surrounding areas. It contains an assemblage of vegetation communities that are commonly found in the highly fragmented grazing environment of the Southern and Central Tablelands, with a number of exposed rocky hilltops supporting western scribbly gum (*E. rossi*) that are representative of extensive (but largely un-reserved) tracts of land between Marulan and Goulburn.

The project will require the removal of approximately 103 hectares of native vegetation. The impacts of the project on each vegetation community are summarised in **Table 4.1**.

Table 4.1 - Area of Impact on each Vegetation Community

Vegetation Community	Approximate Area of Project area	Approximate Area likely to be removed (and proportion of existing)	Area remaining	Extent Cleared Regionally
Tableland Grassy Box – Gum Woodland	75 ha (7%)	43 ha (57%)	32 ha (43%)	93,200 ha (75-90%)[1]
Tableland Low Woodland	111 ha (11%)	15 ha (14%)	96 ha (86%)	31,900 ha (40-60%)[1]
Western Tablelands Dry Forest	172 ha (17%)	35 ha (20%)	137 ha (80%)	90,200 ha (45-65%)[1]
Riparian Gum – Box – Apple Woodland	33 ha (3%)	8 ha (24%)	25 ha (76%)	high[2]
Camden Woollybutt Low Woodland	0.18 (0.02%)	0.18 ha (100%)	0 ha (0%)	unknown
Miscellaneous Planted Areas	1.8 (0.2%)	1.8 ha (100%)	0 ha (0%)	unknown
Derived Pasture	633 ha (62%)	345 ha (55%)	288 ha (45%)	low[2]
Totals (including Derived Pasture)	**1025 ha (100%)**	**448 ha (44%)**	**577 ha (56%)**	**-**
Total of Woodland / Forest Vegetation	**393 ha (100%)**	**103 ha (26%) of woodland / forest**	**290 ha (74%)**	**-**

Notes: [1] Tindall et al. (2004)
[2] Authors' estimate.

Table 4.1 shows that the three dominant vegetation communities in the project area have been at least moderately through to extensively cleared within the region, according to calculations by Tindall et al. (2004). It was not possible to find correlating vegetation communities for Riparian Gum – Box – Apple Woodland, Camden Woollybutt Low Woodland, Miscellaneous Planted Areas or Derived Pasture, however, in the former case it is likely that this vegetation community has been highly cleared at the regional scale.

The project will require a high proportion of Camden Woollybutt Low Woodland and Tableland Grassy Box-Gum Woodland to be cleared, however, a large proportion of the other dominant natural vegetation communities will be retained. It is proposed to completely offset the removal of Camden Woollybutt Low Woodland with a new revegetated site (refer to **Section 5.2.1**).

To offset the loss of the remaining vegetation communities, Readymix will establish a Habitat Management Area to manage and conserve remnant native vegetation in the northeast of the project area. Revegetation and assisted rehabilitation will also be undertaken in this area to expand the existing vegetated area. Readymix will also assist the regeneration of riparian vegetation within the project area, particularly along Joarimin Creek north of the Main Southern Railway. As discussed in **Section 5.2**, these measures will largely offset the loss of native vegetation as a result of the project. The residual loss of particular vegetation communities will be addressed by recreation of those communities during rehabilitation of the emplacement areas and other disturbed quarry areas.

The project will result in a reduction of flow along Joarimin and Lockyersleigh Creeks within the project area. This has the potential to impact on aquatic vegetation. Within and immediately downstream of the project area, these creeks consist of a chain of ponds, with only periodic flows. These ponds provide habitat for riparian vegetation. Although the project will reduce flows along these creeks, it is not expected that the present extent of 'ponds' along the creeks will be affected, as sufficient flows will remain to ensure this habitat remains. The project is therefore considered unlikely to significantly impact on aquatic vegetation.

No EECs were recorded in the project area. Database searches conducted prior to the field survey and general environmental conditions indicated that there was some possibility that two EECs could occur: Natural Temperate Grassland of the Southern Tablelands of NSW and the Australian Capital Territory (listed under the EPBC Act); and White Box Yellow Box Blakely's Redgum Woodland (listed under the TSC Act). Detailed surveys did not, however, locate these vegetation communities. Assessments of species composition of vegetation communities in the project area were made against published species compositions for both vegetation communities, however, there was not enough similarity to suggest that either vegetation community was present. **Section 3.1.3** details these comparisons.

As a result of the above assessment, the impact of the project on local and threatened vegetation communities is unlikely to be significant, particularly when considering the proposed mitigation measures outlined in **Section 5.0**. These measures include the establishment of a Habitat Management Area, rehabilitation of riparian corridors and revegetation with the aim of establishing a vegetated corridor through the project area.

4.3 FAUNA

The project area is located in a region that has been subject to a long history of vegetation clearing for agricultural purposes such as grazing. This has led to the current condition where the vegetation of the region is highly fragmented and disturbed. Many such fragments consist mainly of canopy species with little diversity in the understorey. This may be due to grazing, underscrubbing or the domination of particular species benefited by such disturbances.

The project will result in the loss of approximately 100 hectares of native vegetation and fauna habitat within the project area. While this will pose an impact on fauna species utilising that habitat, it is considered unlikely that this impact will be significant. This is due to a number of factors, including the proximity of the project area to similar adjoining vegetation, as well as detailed ameliorative measures that will be implemented as part of the project. Such measures include the establishment of a Habitat Management Area in the northeastern corner of the property (refer to **Section 5.2.2**), the revegetation of areas within the project area, erection of nest boxes and implementation of detailed clearing processes to reduce the impact on native fauna, particularly threatened species.

Localised fragmentation is an impact that must be considered for projects that involve clearing of native vegetation. The vegetation on the project area (and in the local area in general) is highly fragmented into pockets of vegetation of varying sizes, features and habitat quality. Many fragments consist of canopy species only, with little or no understorey vegetation. Such areas are likely to provide greatly reduced protection to fauna species, particularly when dispersing. While the clearing associated with the project is likely to contribute to the fragmentation of the existing vegetation of the project area, ameliorative measures proposed include the management of a large area of continuous vegetation and the revegetation of areas in order to increase connectivity throughout and from the project area for dispersing fauna (refer to **Section 5.0**).

Five threatened species were identified in the project area, being the squirrel glider (*Petaurus norfolcensis*), speckled warbler (*Pyrrholaemus sagittata*), eastern bentwing bat (*Miniopterus schreibersii oceanensis*), eastern false pipistrelle (*Falsistrellus tasmaniensis*) and eastern freetail-bat (*Mormopterus norfolcensis*). Section 5A of the EP&A Act (eight-part test) and EPBC assessments found that the local populations of these species will not be significantly impacted by the project (refer to **Appendices C** and **D**). The proposed habitat enhancement and rehabilitation measures outlined in **Section 5.0** will further limit any potential impacts on these species.

A further fifteen threatened species were considered to have potential habitat in the project area, being the giant burrowing frog, Rosenberg's goanna, striped legless lizard, blue-billed duck, swift parrot, barking owl, masked owl, brown treecreeper, regent honeyeater, hooded robin, diamond firetail, spotted-tailed quoll, squirrel glider, grey-headed flying fox and large-eared pied bat. None of these

species were recorded in the project area and assessment under Section 5A of the EP&A Act 1979 and EPBC Act 1999 found that it is unlikely that the proposal will disrupt the lifecycle of any of the above species such that a viable population will be placed at risk of extinction (refer to **Appendices C** and **D**).

Seven migratory species were recorded in the project area during surveys conducted for this project. An assessment of significance undertaken for these migratory species under the provisions of the EPBC Act 1999 (refer to **Appendix D**) indicates that the project area does not comprise an important area of habitat for these listed species and that the project is unlikely to have a significant impact on migratory species.

The project is subject to assessment under *State Environmental Planning Policy* (SEPP) *No. 44 (Koala Habitat Protection)* as it lies in a local government area listed in Schedule 1 of the policy and is on land that has an area of more than one hectare. SEPP 44 aims to encourage the proper 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. Any development application in an identified local government area, that is on land of one hectare or greater, must be assessed under the policy.

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 stratum 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 of the policy are:

Scientific Name	**Common Name**
Eucalyptus tereticornis	forest red gum
Eucalyptus microcorys	tallowwood
Eucalyptus punctata	grey gum
Eucalyptus viminalis	ribbon or manna gum
Eucalyptus camaldulensis	river red gum
Eucalyptus haemastoma	broad leaved scribbly gum
Eucalyptus signata	scribbly gum
Eucalyptus albens	white box
Eucalyptus populnea	bimble box or poplar box
Eucalyptus robusta	swamp mahogany

No species of 'koala feed tree' were identified in the project area, and therefore the project area does not constitute potential koala habitat. No further provisions of this policy apply.

4.4 ASSESSMENT OF KEY THREATENING PROCESSES

A number of key threatening processes listed under the Schedules of the TSC Act and the *Fisheries Management Act* 1994 have been identified as potentially being relevant the project.

Those 'Key Threatening Processes' with the potential to be relevant to this project have been listed below. With each, an assessment of the applicability of the threatening process to the project is provided.

- **Clearing of native vegetation:** The clearing of native vegetation is listed as a major factor contributing to the loss of biological diversity. As the project area has been cleared in the past it may be stated that this Key Threatening Process has already impacted the project area. Further planned clearing will increase this existing impact, however, the proposed retention of areas of vegetation as well as proposed planting programs will lessen this impact.

- **Invasion of native plant communities by exotic perennial grasses:** The project area already contains moderate to high levels of exotic perennial grasses, thus this Key Threatening Process is likely to already impact the project area. The disturbance of the project area as a result of the project may increase the prevalence of these species, however, this is not considered to be a significant risk. Appropriate environmental management measures such as use of indigenous species only in plantings and eradication of weed species will serve to maintain this potential impact at acceptable levels.

- **Predation by the feral cat *Felis catus*:** The feral cat (*Felis catus*) was recorded in the project area during the survey and is likely to occur throughout the locality. The project is unlikely to increase the numbers of feral or domestic cats in the area.

- **Predation by the European red fox *Vulpes vulpes*:** The European red fox (*Vulpes vulpes*) was recorded in the project area during the survey and is likely to occur throughout the locality. The project is unlikely to result in the increase in numbers of this species within the locality.

- **Competition and grazing by the European rabbit *Oryctolagus cuniculus*:** This species was identified in the project area and is likely to be prevalent in the local area. The project is unlikely to result in the increase in numbers of this species within the locality.

- **High frequency fire resulting in the disruption of life cycle processes in plants and animals and loss of vegetation structure and composition:** There was little evidence of past fire history observed during surveys of the project area. The project is unlikely to increase the frequency of fires within the locality. Bushfire management is considered in detail in the main text of the Environmental Impact Statement (EIS).

- **Bushrock Removal:** The nature of the project indicates that bushrock will be removed, however, only in areas in which quarrying or associated activities will occur. Areas outside the disturbance area will be unaffected.

- **Alteration to the natural flow regimes of rivers, streams, floodplains & wetlands:** Works within or across a number of creek/drainage lines will be required as part of the project and surface water capture by the quarry pit and associated disturbance areas will impact on flow regimes. While these issues have been addressed elsewhere in the EIS, it is likely that these works will constitute this Key Threatening Process.

- **Removal of dead wood and dead trees:** Moderate levels of dead wood and dead trees were present across the project area. These habitat features were more common in Tableland Low Woodland (dominated by western scribbly gum *E. rossii*) to the south of the Main Southern Railway. The dead wood and trees occurring within the proposed disturbance footprint will require removal, however, the recommended salvage and relocation of such resources (refer to **Section 5.1**) will reduce the potential impact of this action.

Key Threatening Processes currently listed under the *Fisheries Management Act* 1994 with the potential to be relevant to this project have been listed below. With each, an assessment of the applicability of the threatening process to the project is provided.

- **The removal of large woody debris:** The project will require works within aquatic habitats in several locations for creek crossing points etc, however, the majority of aquatic habitats will

remain unaffected. While every effort will be made to avoid the removal of large woody debris, this may be required as part of the project in these limited locations. The project may represent this Key Threatening Process.

- **The degradation of native riparian vegetation along NSW water courses:** The project will require works within riparian habitats. All effort will be made to reduce the impact of works on riparian vegetation, with the proposed revegetation of the riparian zones providing a beneficial environmental outcome as part of the project. The project may represent this Key Threatening Process.

- **The installation and operation of in-stream structures and other mechanisms that alter natural flow regimes of rivers and streams:** The project will require works within aquatic habitats. Due to the position of such habitat within the site, it will be necessary to remove or cross these habitats at certain points. Such crossing areas are likely to require works to ensure accessibility and stability and may include the construction of features such as culverts. In such cases, these structures will be designed to create minimal alteration to the natural flow regimes of the waterway in accordance with DIPNR and the Department of Primary Industries (DPI) Fisheries division guidelines. The project may represent this Key Threatening Process.

5.0 ECOLOGICAL MANAGEMENT RECOMMENDATIONS

5.1 GENERAL ECOLOGICAL MANAGEMENT STRATEGIES

A range of management strategies will be used by Readymix to limit impacts on endemic flora and fauna in the project area. The strategies will include:

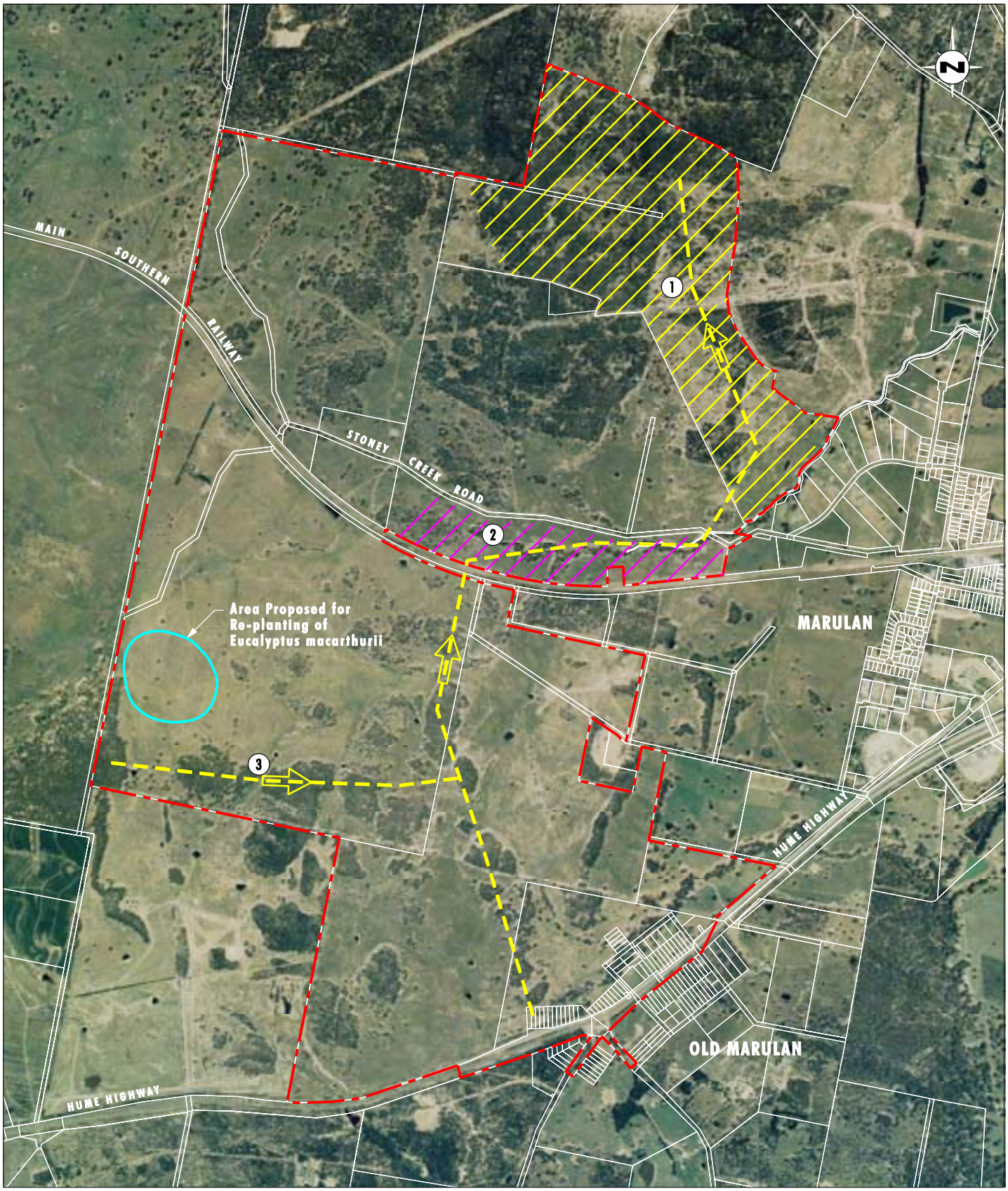
- management of noise and dust to minimise impacts on adjoining vegetation communities and fauna as addressed in the main text of the EIS;
- feral animal and noxious weed control as addressed in **Section 5.0**;
- rehabilitation of disturbed areas with local indigenous species as addressed in **Section 5.3**;
- use of local indigenous species in landscaped areas and the linkage and integration of new areas with existing vegetated areas to improve ecological function and provide habitat as addressed in **Section 5.3**;
- management of erosion and sedimentation to ensure that adjoining vegetation communities and aquatic systems are not disturbed as addressed in the main text of the EIS;
- management of surface water to ensure that adjoining vegetation communities, aquatic systems and associated fauna are not disturbed as addressed in the main text of the EIS;
- management of fire regimes as addressed in the main text of the EIS;
- adaptive management, as required, if a previously unrecorded or assessed threatened species is identified in the project area during construction or operation as addressed in **Section 5.5.6**;
- ongoing monitoring and maintenance of all revegetation works and habitat enhancement activities; and
- creation of habitat corridors linking isolated remnant vegetation stands (refer to **Section 5.4** and **Figure 5.1**).

5.1.1 Protection of Arboreal Habitat

Trees will be cleared in accordance with the procedure described below. A detailed clearing procedure will be developed as part of the Lynwood Quarry Environmental Management System. Where possible, salvaged micro-habitats (tree hollows, logs, etc.) will be relocated to areas lacking in tree hollow habitat. The identification of tree hollows is to be undertaken by an appropriately qualified and experienced ecologist following a pre-clearance inspection.

The following clearing procedure has been prepared to minimise the potential for impact on indigenous fauna species, including threatened species, as a result of the clearing of hollow bearing trees:

1. Clearing will be undertaken, where practicable, during the months of March, April and May, in order to minimise impacts on hollow-dependant fauna, especially threatened fauna.
2. Within the area of clearing, hollow-bearing trees and other habitat structures such as stags, logs and stumps will be marked by a qualified ecologist to prevent accidental clearing. At this time, an estimate will be made on the number of hollows that will be lost as a result of the tree clearing operations. This will determine the number and type of nest boxes that will be required to be erected in adjoining habitat to ameliorate this loss. Hollow loss will be ameliorated using either



Base Source: LPI 2004, Readymix Holdings Pty Ltd (Aerial Photo March 2005)

0 0.5 1 1.25km

Legend

- Project Area
- Proposed Habitat Management Area
- Vegetation Corridor
- Riparian Zone Rehabilitation
- ① Proposed Monitoring Areas

FIGURE 5.1

Areas Proposed for Biodiversity Management and Monitoring

nest boxes or re-erected tree hollows, to result in no net loss of nesting habitat. Each felled tree will be inspected for hollows that show signs of past or present usage, and those hollows will be replaced at a ratio of 1:1. Nest boxes will be of a variety of designs to suit different fauna groups such as parrots, owls, possums, gliders and bats, determined by the size and dimensions of used hollows in felled trees. Designs will be prepared according to recognised guidelines such as *The Nestbox Book* (Grant 1997).

3. Vegetation surrounding the hollow-bearing trees and marked habitat structures will be cleared and left undisturbed for a period of 24 hours. A qualified ecologist will be present to observe clearing activities and to minimise harm to any fauna encountered.

4. Prior to clearing of hollow-bearing trees, hollows will be observed where practicable to determine their use by fauna.

5. Following this, all hollow-bearing trees will be shaken using a bulldozer. Those hollow-bearing trees without identified resident fauna will then be felled. Hollow-bearing trees with resident fauna identified the previous night will be left standing for a period of 24 hours to allow any fauna using the hollows to move to another area.

6. Should no signs of fauna usage be observed, approved hollow-bearing trees will be slowly pushed over using a bulldozer. If possible, the trees will be lowered gently to minimise harm to any undetected fauna and preserve hollows for rehabilitation activities.

7. At any time during this procedure, additional methods may have to be used to discourage animals from continually returning to hollows. This may require activities such as trapping, tree climbing to capture the animal, or partial destruction of the tree.

8. Following felling, each of the identified hollows will be examined for remaining fauna.

9. Where necessary (at the discretion of the supervising ecologist), felled trees will be left for a period of 24 hours prior to removal and/or cutting in order to allow fauna hidden in un-viewable hollows to move into adjoining vegetation of their own volition.

10. Captured, uninjured animals will be released on the day of capture and will not be held for extended periods of time.

11. Suitable hollows and other habitat structures including logs, stumps and stags will be retained for relocation into adjoining habitat areas. Hollows intended for re-erection will be removed using a chainsaw and then capped with marine plywood.

12. Logs, stumps, stags and hollows intended for ground habitat will be cut into sections, as required and relocated to suitable habitat areas.

13. In the event that injured fauna are identified, individuals will be immediately taken to the nearest veterinarian or certified wildlife carer for treatment.

5.1.2 Enhancement of Arboreal Habitat

The maintenance and replacement of arboreal habitat will be achieved through the relocation of salvaged tree hollows and, where required, the establishment of nest boxes. Usable tree hollows lost during clearing activities will be replaced at a ratio of 1:1 (refer to **Section 5.1.1**) using salvaged tree hollows and nest boxes. The final number of nest boxes required will be determined by the number of hollows identified minus the number of suitable salvaged hollows. Prior to the commencement of operation of the quarry, 40 nest boxes will be erected in the habitat management area and along Joarimin Creek to offset any initial loss of habitat during clearing. Half of these nest boxes will be suitable for squirrel gliders (refer to **Section 5.1.3**).

All nest boxes should be constructed from marine grade plywood and have a hinged lid to enable their occupancy to be monitored. The details on the specific height, aspect, design, location and timing for the placement of nest boxes required should be included in a report from the ecologist supervising the erection of the nest boxes. During the monitoring of nest boxes the condition of the boxes will be determined and the need for maintenance identified.

5.1.3 Enhancement and Protection of Squirrel Glider Habitat

The squirrel glider was identified along Lockyersleigh Creek in the northwest of the project area, with four individuals including a juvenile recorded. The species was also tentatively recorded along Joarimin Creek. Squirrel gliders have home ranges between 0.65 and 8.55 hectares with each home range including several suitable den sites (NSW NPWS 1999j). The area in which the species was recorded along Lockyersleigh Creek and surrounding trees will be removed as part of the project. In order to minimise impacts on the squirrel glider, the following habitat enhancement and protection recommendations will be implemented:

- the section of Joarimin within the property boundary and north of the Main Southern Railway will be fenced off to protect the riparian corridor and encourage natural regeneration (refer to **Figure 5.1**). This natural regeneration will be supplemented, where necessary, with plantings of indigenous species to provide future foraging and nesting habitat for the squirrel glider;

- within the existing riparian corridor along Joarimin Creek, nest boxes suitable for squirrel gliders will be established at a density of one box for every 2 hectares of existing riparian woodland;

- nest boxes designed for squirrel gliders will also be established in the Habitat Management Area (refer to **Section 5.2.2**);

- squirrel glider nest box design should follow reference texts such as Grant (1997). Nest boxes should be positioned 5 to 6 metres high in a sheltered position or with a southeasterly aspect; and

- the monitoring of nest boxes established for squirrel gliders will be included in the annual monitoring of nest boxes (refer to **Section 5.5.4**).

5.2 MANAGEMENT AND RE-ESTABLISHMENT OF NATIVE VEGETATION

A number of measures will be used to offset the loss of native vegetation as a result of the project. These measures will include:

- management of the remnant vegetation outside the proposed disturbance area;

- establishment of a Habitat Management Area in the northeastern portion of the project area;

- re-establishment of Camden Woollybutt Low Open Forest;

- rehabilitation of riparian zones;

- establishment of a vegetated corridor through the project area; and

- creation of additional areas of native vegetation through rehabilitation of disturbed quarry areas.

These measures are discussed in further detail below.

5.2.1 General Vegetation Management

A Property Management Plan will be prepared for the project area to address non-quarrying land use and land management measures. A key focus of this plan will be the management of remnant native vegetation. The plan will detail how grazing is to be managed in woodland remnants, but in general, stock will only be used to assist in weed management and will be gradually excluded for greater periods of time in the future, until total exclusion is determined to be desirable from an ecological perspective. In areas south of the Main Southern Railway where less remnant vegetation occurs, managed grazing will continue. The plan will also identify any areas where regeneration will be encouraged around woodland remnants to further enhance their ecological integrity.

Specific management requirements for remnants include:

- the general exclusion of stock and prevention of unrestricted access by fencing;
- ongoing management of weeds and pests; and
- management of fire regimes to restrict the occurrence of high intensity burns but to allow infrequent burns of moderate intensity to set seed.

Management of weeds and pests will be determined by the results of monitoring, with control mechanisms to be documented in the Property Management Plan.

5.2.2 Habitat Management Area

It is proposed to establish a Habitat Management Area in the northeast of the project area (refer to **Figure 5.1**). This area will be managed for the conservation of ecological values. The establishment of the Habitat Management Area will involve enhancement of the floristic and fauna habitat values through the restriction of access, management and general exclusion of stock, and the planting or assisted regeneration of indigenous species in appropriate locations to enhance the condition of the existing stand.

The Habitat Management Area will improve the future viability of indigenous flora, fauna and vegetation communities in the project area and will be linked to remnant woodland along Joarimin Creek and south of the Main Southern Railway through the proposed vegetation corridor (refer to **Section 5.2.3**). It will also allow the persistence of the *Pomaderris* species, which is yet to be identified and could possibly constitute a new species. **Section 5.2.2.1** provides further details.

The ongoing management of the Habitat Management Area will be addressed by the Property Management Plan.

5.2.2.1 Management of *Pomaderris* species

One site within the proposed Habitat Management Area, supports a small population of what may be an undescribed species. Specimens were identified by Neville Walsh at the National Herbarium of Victoria as most likely being *Pomaderris lanigera* - *P. intermedia/ andromedifolia*. Mr Walsh also indicated that there is a reasonable chance that the specimen could represent a new as yet undescribed species (refer to **Section 3.1.3**).

Approximately 10 individuals of the taxon were recorded within the proposed Habitat Management Area (refer to **Figure 3.1**). Given the taxonomic uncertainty of the specimens and the possibility that they represent a new species, it is regarded in this assessment as a significant species. The Habitat Management Area will encourage the future viability of the population and will allow future research and monitoring to assess the status of the taxon, and to assess changes over time.

5.2.3 Re-establishment of Camden Woollybutt Low Open Forest

An area south of the Main Southern Railway will be revegetated to compensate for the loss of Camden Woollybutt Low Open Forest. At least 0.4 hectares (more than double the area proposed to be cleared) of Camden Woollybutt Low Open Forest will be established using *Eucalyptus macarthurii* seed collected from within the project area, where possible. The general location in which Camden Woollybutt Low Open Forest will be established is shown on **Figure 5.1**.

5.2.4 Establishment of Vegetation Corridor

It is proposed that isolated stands of remnant vegetation within the project area be linked through vegetation corridors. **Figure 5.1** shows the general location of the proposed vegetation corridor. The corridor will link isolated remnants of vegetation south of the Main Southern Railway, with Joarimin Creek and north through to the Habitat Management Area. The core corridor will be to the north of the Main Southern Railway linking remnant vegetation along Joarimin Creek with the proposed Habitat Management Area and adjoining habitat areas to the north. Linkages to this core corridor area will also be provided by a 'stepping stone' corridor to the south of the Main Southern Railway. This section of the corridor is comprised of patches of remnant vegetation and will be crossed by infrastructure in several locations. Despite this, it will form a movement corridor able to be utilised by more mobile species such as bats and birds.

The corridor will be established through revegetation and assisted regeneration to the north of the Main Southern Railway, as well as encouraging the regeneration of native vegetation to the south of the railway through improved stock management. The Property Management Plan will detail the management measures to be implemented, including stock management, to improve corridor function.

5.2.5 Rehabilitation of Disturbed Areas

Areas disturbed by the project will be rehabilitated using native species to create native vegetation communities similar in composition to those presently found within the project area. Rehabilitation will be undertaken progressively throughout the life of the project as areas become available. Rehabilitation practice and staging is discussed in detail in the main text of the EIS. Rehabilitation works will include the spreading of cleared vegetation (including mulch created during clearing) over the rehabilitated surfaces to provide organic matter and a local seed source, plus seeding of topsoiled areas with native species.

Species suitable for use in rehabilitation works are listed in **Appendix E**. The revegetation species list has been divided into vegetation community type to allow use of species mixes that will result in the creation of specific vegetation communities. Vegetation communities to be targeted for use in rehabilitation works are discussed in **Section 5.2.6**.

5.2.6 Extent of Vegetation Communities in Management & Rehabilitation Areas

The overall aim of the vegetation management measures discussed above and the proposed rehabilitation program, is to ensure no net loss of vegetation within the project area. This aim has been extended to achieving no net loss of vegetation communities currently occurring in the project area. These aims will be achieved through the creation of specific habitat management areas, revegetation and regeneration works and through rehabilitation of disturbed quarry areas. Approximately 103 hectares will be cleared as part of the project with the extent of management and rehabilitation areas included in **Table 5.1**.

Table 5.1 – Extent of Vegetation Managed and Revegetated

Area	Total Area (ha)	Area currently vegetated (ha)	Area of revegetation (ha)
Habitat Management Area	130	105	25
Joarimin Creek rehabilitation area	30	10	20
Year 30 rehabilitation[1] area	100	N/A	100
Year 30 closure rehabilitation area[2]	176	N/A	176
Total Area[3]	**260**	**115**	**145**

1 Equates to the area requiring rehabilitation by Year 30 should the quarry continue beyond 30 years of operation as planned.

2 Equates to the total area requiring rehabilitation should the quarry be closed and decommissioned after 30 years of operation.

3 Assuming ongoing operation of the quarry post Year 30.

Table 5.2 provides an indication of the area of each community proposed to be included in management area, including areas created as a result of regeneration / revegetation works compared to the area of each vegetation community cleared as part of the project.

Table 5.2 - Area of Impact on each Vegetation Community

Vegetation Community	Approximate Area to be removed (ha)	Area present in management areas (ha)	Area proposed to be established in management areas	Total (area removed vs area managed) (ha)
Tableland Grassy Box – Gum Woodland	43	4	7	-32
Tableland Low Woodland	15	18	15	+18
Western Tablelands Dry Forest	35	81	10	+56
Riparian Gum – Box – Apple Woodland	8	9	18	+19
Camden Woollybutt Low Woodland	0.18	0	0.4 ha will be recreated outside of management areas	+0.22
Miscellaneous Planted Areas	1.8		0	-1.8
Total of Woodland / Forest Vegetation	**103.2 ha (22%) of woodland / forest**	**112**	**50.4**	**59.4**

Note: [1]HMA = Habitat Management Area

Table 5.2 shows that all but one vegetation community will have an equal or greater amount of its area protected within the management areas than will be cleared, Tableland Grassy Box – Gum Woodland. To address this situation this community will be established during rehabilitation works on the Western Overburden Emplacement Area and the Western Excess Product Emplacement Area which will create an additional approximately 35 hectares of this community. The remaining rehabilitation areas will be rehabilitated to be consistent with adjoining remnant vegetation and in consideration of factors such as aspect, slope and soil properties as relevant.

5.3 MONITORING AND MAINTENANCE

The aim of the ecological monitoring program will be to:

- document changes in the structure, composition and condition of revegetation or regeneration areas, through comparison with benchmark sites;
- document changes in retained vegetation, through comparison with the first year data and comparison with predictions in the EIS;
- determine if the impacts on identified threatened species are consistent with predictions in the EIS; and
- assess changes to fauna species assemblages within the project area.

Monitoring in rehabilitation or regeneration areas will be undertaken at least annually. Monitoring in retained vegetation will commence with the establishment of detailed sites during the first year to act as benchmark sites against which to compare the progress of rehabilitation or regeneration areas. Future monitoring in retained vegetation could then be undertaken at three-yearly intervals.

Monitoring for flora and fauna may need to be undertaken at different times, depending on whether or not flowering periods coincide with periods when fauna are most detectable. Factors to consider include migration patterns, temperature and day length.

Monitoring programs will involve the assessment of retained vegetation, revegetation and regeneration areas (including the proposed corridor) and aquatic habitat. **Figure 5.1** shows general locations where monitoring is recommended to be undertaken. The assessment process will result in a monitoring report that will provide details of the flora and fauna species and ecological communities present at each site, identify the impact of the proposal over time and, as appropriate, to provide ameliorative methods and management recommendations in order to protect and enhance the ecological diversity of the site.

An environmental monitoring program will be prepared for the project and will detail the proposed ecological monitoring program, as well as the specific methods to be used.

5.3.1 Monitoring Locations

It is proposed that four monitoring locations be established in the project area (refer to **Figure 5.1**)

Area 1 will include the extensive remnant vegetation in the northeastern portion of the project area, that will be retained and partly revegetated. Area 1 comprises the proposed Habitat Management Area. This area also includes the site at which *Pomaderris lanigera - P. intermedia/andromedifolia* was located, and for which an additional monitoring program is proposed (see **Section 5.3.2.1**).

Area 2 lies in the centre of the project area, and extends along Joarimin Creek north of the Main Southern Railway.

Area 3 is the proposed Cultural Heritage Management Area located in the southwestern portion of the project area.

5.3.2 Monitoring of Retained Vegetation

The condition of retained vegetation will be monitored to identify any deterioration or improvement in habitat quality. The monitoring surveys will assess the following vegetation characteristics and the results will be recorded on a standard recording sheet, including:

- general health of vegetation;
- evidence of natural regeneration;
- occurrence and abundance of weed species;
- signs of disturbance, either by stock or humans;
- evidence of feral animals; and
- any observable impacts of the operations, such as the effectiveness of sediment and erosion control structures.

The Environmental Monitoring Protocol will detail the techniques to be utilised to assess each monitoring site. In general, the approach will be to undertake systematic and repeatable surveys at sites that are able to be readily re-visited. A standard 20 metre by 20 metre quadrat vegetation survey will be completed in order to record species diversity and structural composition of the vegetation at each systematic monitoring site. This will allow a comparison of flora species and abundance over time. Photomonitoring will also be a key component of the monitoring program.

The monitoring points will be selected and surveyed during the first year of the project. Subsequent monitoring will then be undertaken every three years, with monitoring frequency to be assessed on an ongoing basis by the Environmental Monitoring Program.

5.3.2.1 Monitoring of *Pomaderris* Species

Monitoring will specifically include an assessment of the area containing the known stand of *Pomaderris lanigera* - *P. intermedia/andromedifolia* in the Habitat Management Area. Monitoring at this site will be undertaken in a similar manner to other botanical monitoring, but will also include, but not necessarily be limited to:

- collection of an adequate amount of material, in conjunction with the Royal Botanic Gardens Melbourne, to enable taxonomists to determine the taxon's identity; and
- specific targeted surveys in other parts of the buffer zone to search for the taxon.

Monitoring will be undertaken annually for at least the first three years once initial disturbance is made. Once the taxon has been adequately described, the monitoring plan will be revised and updated to reflect the relative significance of the taxon. Options may include continued or increased monitoring, reduction in monitoring, implementation of other management practices or no further action, depending on the significance of the taxon.

5.3.3 Monitoring of Revegetated Areas

Monitoring of any revegetated areas will include annual checks of the following aspects:

- revegetation germination rates;
- plant health;
- feral animals and the need for control;
- weed infestation and the need for control;

- requirements for additional planting to be undertaken;
- need for further fertilisation;
- requirement for application of lime or gypsum to control pH and improve soil structure;
- erosion and the need for repair of eroded areas;
- fire management;
- quality and effectiveness of fencing;
- signs of disturbance, either by animals or humans; and
- success of any management programs implemented following previous monitoring inspections.

In addition, the standard monitoring approach (refer to **Section 5.3.2**) will be completed in selected rehabilitation areas every three years, including in the Camden Woollybutt revegetation area, in order to record species diversity and structural composition of the vegetation. This will allow a comparison of flora species and abundance over time.

In the event that the above monitoring reveals unsatisfactory progress, recommendations will be provided to rectify the situation.

5.3.4 Fauna Monitoring

At proposed monitoring points one to three (refer to **Figure 5.1**), a range of fauna survey techniques will be employed to determine ongoing fauna use of habitat within the project area, particularly focussing on the ongoing presence of threatened species. It is proposed that thorough monitoring of fauna be undertaken once every three years, consistent with retained vegetation monitoring (refer to **Section 5.3.2**). The Environmental Monitoring Program will detail the types of surveys that will be required to undertake adequate monitoring of fauna. These may include spotlighting, herpetological surveys, diurnal bird surveys, Anabat echolocation call detection, and the use of hair funnels to detect terrestrial and arboreal mammals, including the squirrel glider (*Petaurus norfolcensis*).

Fauna surveys will specifically target threatened species previously recorded, or with potential to occur within the area. Threatened fauna species previously recorded include the eastern bentwing-bat, eastern false pipistrelle, eastern freetail-bat, squirrel glider and speckled warbler. The results of the monitoring will be analysed and compared to previous survey results to determine general population trends. In the event that negative trends are identified indicating the decline of particular threatened species, appropriate amelioration measures will be determined.

In the event that further threatened species are identified within the project area the monitoring program will incorporate surveys to adequately assess and monitor these species.

It is also proposed that monitoring be undertaken for fauna species in selected areas that are revegetated or allowed to undergo natural regeneration.

5.3.4.1 Nest Box Monitoring

Nest box monitoring will be undertaken annually for five years after the first phase of nest box installation to record the effectiveness of artificial habitat structures. This monitoring will report on the degree of use of nest boxes and make recommendations regarding maintenance activities as required. The need for this monitoring program to continue will be assessed at this time.

Monitoring should be under taken during September each year when the use of boxes by bird species can be detected. While mammal species will den in the nest boxes all year, bird species such as parrots using the boxes solely for breeding will only be present for 8 to 12 weeks during early spring to late spring. All nest box monitoring should be undertaken by a qualified ecologist and an annual report produced.

Nest box condition monitoring will be undertaken for the life of the quarry to prevent loss of boxes through deterioration over time.

5.3.5 Aquatic Monitoring

The condition of the aquatic habitat within the project area will be monitored every three years, to identify any improvement or deterioration in habitat quality. Monitoring will specifically focus on Joarimin Creek, which is the main drainage line in the project area. The monitoring inspections will assess the following characteristics and will be recorded on a standard recording sheet:

- general health of the aquatic vegetation;
- occurrence and abundance of weed species;
- signs of disturbance;
- the habitat attributes of the aquatic vegetation; and
- the presence of amphibian and reptile species utilising the habitat.

Ongoing inspections of drainage lines for stability and to identify any erosion control issues will also be undertaken regularly.

5.3.6 Identification of Additional Threatened Species

If, through the course of monitoring or during general operation of the project, additional threatened species, or new populations of threatened species, are identified, such records will be assessed by a qualified ecologist to advise on the most appropriate course of action. This may result in:

- modification to operational practices;
- modification of the monitoring program; and
- immediate survey and assessment of the new record, and an assessment of the impact of the project on it.

If further threatened species, or significant new records of existing threatened species, are collected, the significance of such records will be reviewed, as will the likely impact of existing or proposed activities, and any options for minimising impacts on these species.

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APPENDIX A

Flora Species List

Appendix A - Flora Species List

Family/Subfamily	*Scientific Name*	Common Name	Site 1	Site 2	Site 3	Site 4	Site 5	Site 6	Site 7	Site 8	Site 9	Site 10	Site 11	Site 12	Site 13	Site 14	Site 15	Site 16	Site 17	Site 18
Filicopsida (Ferns)																				
ADIANTACEAE	*Cheilanthes sieberi* subsp. *sieberi*	poison rock fern	3					2	2			3	2				1			
AZOLLACEAE	*Azolla pinnata*				2															
Magnoliopsida (Flowering Plants) – Liliidae (Monocots)																				
ANTHERICACEAE	*Tricoryne elatior*	yellow autumn-lily			1															
CENTROLEPIDACEAE	*Centrolepis strigosa*																			
CYPERACEAE	*Baumea* sp.				3															
CYPERACEAE	*Carex appressa*	tall sedge																		
CYPERACEAE	*Carex breviculmis*	short-stem sedge																		1
CYPERACEAE	*Carex gaudichaudiana*																			
CYPERACEAE	**Cyperus aggregatus*																1			
CYPERACEAE	**Cyperus eragrostis*	umbrella sedge			2												3	2		2
CYPERACEAE	*Cyperus* sp.				2	2														
CYPERACEAE	*Elaeocharis* sp.				3															
CYPERACEAE	*Fimbristylis dichotoma*	common fringe-rush																		
CYPERACEAE	*Fimbristylis* sp.	a fringe-rush																		2
CYPERACEAE	*Isolepis cernua*	nodding club-rush																		
CYPERACEAE	*Isolepis inundata*																			
CYPERACEAE	*Isolepis* sp.				3	2											1			
CYPERACEAE	*Lepidosperma filiforme*																			
CYPERACEAE	*Lepidosperma gunnii*	a sword-sedge															2			
CYPERACEAE	*Lepidosperma laterale*	variable saw-sedge																		
HALORAGACEAE	*Myriophyllum variifolium*				1															
JUNCACEAE	*Juncus australis*																1	2		1
JUNCACEAE	**Juncus bufonius*	toad rush																		
JUNCACEAE	**Juncus capitatus*																			
JUNCACEAE	*Juncus planifolius*																			
JUNCACEAE	*Juncus sarophorus*																	1		1
JUNCACEAE	*Juncus usitatus*	a rush																		2
JUNCACEAE	*Juncus usitatus X subsecundus*																			
JUNCACEAE	*Juncus* sp.	a sedge			3															

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Family/Subfamily	*Scientific Name*	Common Name	Site 1	Site 2	Site 3	Site 4	Site 5	Site 6	Site 7	Site 8	Site 9	Site 10	Site 11	Site 12	Site 13	Site 14	Site 15	Site 16	Site 17	Site 18
LOMANDRACEAE	*Lomandra confertifolia*																			
LOMANDRACEAE	*Lomandra filiformis*	wattle mat-rush																		
LOMANDRACEAE	*Lomandra filiformis* subsp. *coriacea*	wattle mat-rush																		
LOMANDRACEAE	*Lomandra longifolia*	spiny-headed mat-rush			3															2
LOMANDRACEAE	*Lomandra multiflora* subsp. *multiflora*	many-flowered mat-rush				2											1			
LOMANDRACEAE	*Lomandra obliqua*	twisted mat-rush																		
ORCHIDACEAE	*Caladenia caerulea*	blue caladenia																		1
ORCHIDACEAE	*Diuris* sp.								1											
ORCHIDACEAE	*Microtis unifolia*	common onion orchid																		
ORCHIDACEAE	*Pterostylis* sp.	a greenhood																		
PHORMIACEAE	*Dianella caerulea*	blue flax lily																		
PHORMIACEAE	*Dianella* sp.	a blue flax lily						2	2				3	3		3				1
PHORMIACEAE	*Stypandra glauca*	nodding blue lily																		
POACEAE	**Aira caryophyllea*	silvery hairgrass																		
POACEAE	*Aristida ramosa*	wire grass																		
POACEAE	*Aristida ?ramosa*	wire grass																		
POACEAE	*Austrodanthonia laevis (syn. Danthonia laevis)*	a wallaby grass																		
POACEAE	*Austrodanthonia racemosa (syn. Danthonia racemosa)*	white top																		
POACEAE	*Austrodanthonia racemosa* var. *racemosa (syn. Danthonia racemosa var. racemosa)*	white top																	2	2
POACEAE	*Austrodanthonia setacea*																			
POACEAE	*Austrodanthonia tenuior (syn. Danthonia tenuior)*	a wallaby grass																		
POACEAE	*Austrodanthonia* sp.	a wallaby grass	2	2				2		3	2		2		2					
POACEAE	*Austrostipa densiflora*																			

Appendix A - Flora Species List

Family/Subfamily	*Scientific Name*	Common Name	Site 1	Site 2	Site 3	Site 4	Site 5	Site 6	Site 7	Site 8	Site 9	Site 10	Site 11	Site 12	Site 13	Site 14	Site 15	Site 16	Site 17	Site 18
POACEAE	*Austrostipa scabra* subsp. *falcata (syn. Stipa scabra ssp. falcata)*	speargrass																		
POACEAE	*Austrostipa scabra* subsp. *scabra (syn. Stipa scabra ssp. Scabra)*	corkscrew grass	3	3																
POACEAE	*Austrostipa* prob. *semibarbata*																1	1		2
POACEAE	**Avena fatua*	wild oats																		
POACEAE	**Briza maxima*	quaking grass			2	2														
POACEAE	**Briza minor*	shivery grass						2			2	2								
POACEAE	**Bromus brevis*	a brome																		
POACEAE	**Bromus molliformis*	a soft brome				3														
POACEAE	*Cynodon dactylon*	couch															3	3	2	
POACEAE	*Dichelachne micrantha*	shorthair plumegrass			3	4				2	3	3	4		4					
POACEAE	*Echinopogon caespitosus* var. *caespitosus*	tufted hedgehog grass															1			
POACEAE	*Echinopogon* sp.	a hedgehog grass			2															
POACEAE	**Eleusine tristachya*	goose grass															2	2	2	2
POACEAE	*Elymus scaber*	wheatgrass	3	2		2						2	2							
POACEAE	*Entolasia marginata*	bordered panic																		
POACEAE	*Entolasia stricta*	wiry panic		3																
POACEAE	*Eragrostis brownii*	Brown's lovegrass															1			
POACEAE	**Festuca elatior*	tall fescue																		
POACEAE	**Holcus lanatus*	Yorkshire fog																		
POACEAE	*Lachnagrostis filiformis (syn. Agrostis avenacea var. avenacea)*	blown grass																		
POACEAE	**Lolium perenne*	perennial ryegrass															1			
POACEAE	*Microlaena stipoides* var. *stipoides*	weeping grass																		
POACEAE	*Panicum effusum*	hairy panic																		
POACEAE	*Panicum ?effusum*	hairy panic																		

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POACEAE	*Panicum* sp.	a panic																		
POACEAE	*Paspalum distichum*	saltwater couch			2															
POACEAE	**Pennisetum clandestinum*	kikuyu grass															3	2		1
POACEAE	**Phalaris aquatica*	phalaris																3		
POACEAE	*Poa sieberiana*	snow grass	3		3															
POACEAE	*Poa* sp.											2								
POACEAE	**Polypogon monspeliensis*	annual beardgrass																		
POACEAE	*Themeda australis*	kangaroo grass				2												2		
POACEAE	**Vulpia bromoides*	squirrel tail fescue																		
POACEAE	**Vulpia myuros*	rat's tail fescue															2			
XANTHORRHOEACEAE	*Xanthorrhoea glauca* subsp. *angustifolia*													4						
Magnoliopsida (Flowering Plants) – Magnoliidae (Dicots)																				
APIACEAE	*Hydrocotyle laxiflora*	stinking pennywort			2															
ASTERACEAE	*Brachyscome* sp.			2																
ASTERACEAE	**Carthamus* sp.																			
ASTERACEAE	*Cassinia arcuata*	sifton bush					3	3	3							3			1	
ASTERACEAE	**Cirsium vulgare*	spear thistle															1			
ASTERACEAE	*?Cymbonotus lawsonianus*	bears-ear																		
ASTERACEAE	*Euchiton* sp. (syn. Gnaphalium sp.)																			
ASTERACEAE	**Gamochaeta calviceps*	cudweed																		
ASTERACEAE	**Gamochaeta* sp. *(syn. *Gnaphalium sp.)*	a cudweed																		1
ASTERACEAE	**Hypochaeris radicata*	catsear				2											2	2	2	
ASTERACEAE	*Olearia viscidula*	wallaby weed															1			
ASTERACEAE	**Onopordum acanthium*	scotch thistle																		
ASTERACEAE	*Senecio quadridentatus*	cotton fireweed																		
ASTERACEAE	**Sonchus oleraceus*	common sowthistle	2		2	2						2	3					1		
ASTERACEAE	**Taraxacum officinale*	dandelion	2		2	2	2	2		2	2	3	2		2					

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ASTERACEAE	*Vittadinia* sp.	a fuzzweed																		
BORAGINACEAE	**Echium plantagineum*	Paterson's curse			1															
BRASSICACEAE	**Brassica nigra*	black mustard																		
BRASSICACEAE	**Lepidium africanum*	common peppercress															2	2	1	
BRASSICACEAE	**Rapistrum rugosum*	turnip weed																		
BRASSICACEAE	*Rorippa* sp.																1			
CAMPANULACEAE	*Wahlenbergia* sp.	native bluebell			1	2		2						1	2	2				
CARYOPHYLLACEAE	**Cerastium glomeratum*	mouse-ear chickweed																		
CARYOPHYLLACEAE	**Paronychia brasiliana*	Chilean whitlow wort															1			
CARYOPHYLLACEAE	**Petrorhagia nanteuilii*	proliferous pink			1															
CASUARINACEAE	*Allocasuarina littoralis*	black sheoak					2	2												
CHENOPODIACEAE	*Einadia nutans*	climbing saltbush															1			
CHENOPODIACEAE	*Einadia trigonos*	fishweed																		
CHENOPODIACEAE	*Einadia* sp.	a saltbush		2																
DILLENIACEAE	*Hibbertia obtusifolia* complex	hoary guinea flower					3		2					2						
DILLENIACEAE	*Hibbertia* sp.	a Guinea flower			1			2												
DROSERACEAE	*Drosera peltata*								2											
EPACRIDACEAE	*Leucopogon muticus*	blunt beard-heath																		
EPACRIDACEAE	*Leucopogon* sp.			3							3	2	3							
EPACRIDACEAE	*Lissanthe strigosa*	peach heath															1	1		2
EPACRIDACEAE	*Melichrus erubescens*	ruby urn heath																		
EPACRIDACEAE	*Melichrus urceolatus*	urn heath																		1
EUPHORBIACEAE	*Phyllanthus virgatus*	a spurge																		
EUPHORBIACEAE	*Phyllanthus* sp.	a spurge																		
EUPHORBIACEAE	*Poranthera microphylla*	small poranthera																		
FABACEAE - FABOIDEAE	*Glycine* sp.	a glycine	2	2	2	3						4								
FABACEAE - FABOIDEAE	*Hardenbergia violacea*	false sarsaparilla																		
FABACEAE - FABOIDEAE	*Hovea heterophylla*																			
FABACEAE - FABOIDEAE	**Medicago* sp.	a medic	2																	
FABACEAE - FABOIDEAE	**Trifolium arvense*	haresfoot clover																		

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Family/Subfamily	*Scientific Name*	Common Name	Site 1	Site 2	Site 3	Site 4	Site 5	Site 6	Site 7	Site 8	Site 9	Site 10	Site 11	Site 12	Site 13	Site 14	Site 15	Site 16	Site 17	Site 18
FABACEAE - FABOIDEAE	**Trifolium campestre*	hop clover																		
FABACEAE - FABOIDEAE	**Trifolium glomeratum*	clustered clover																		
FABACEAE - FABOIDEAE	**Trifolium repens*	white clover			2															
FABACEAE - FABOIDEAE	**Trifolium* sp.	a clover																		
FABACEAE - FABOIDEAE	**Trifolium subterraneum*	subterranean clover																		
FABACEAE - MIMOSOIDEAE	*Acacia amblygona*	fan wattle																		
FABACEAE - MIMOSOIDEAE	*Acacia brownii*	prickly Moses																		
FABACEAE - MIMOSOIDEAE	*Acacia cultriformis*	knife-leaved wattle																		
FABACEAE - MIMOSOIDEAE	*Acacia decurrens*	black wattle			2			2											1	
FABACEAE - MIMOSOIDEAE	*Acacia genistifolia*	early wattle																		
FABACEAE - MIMOSOIDEAE	*Acacia gunnii*	ploughshare wattle																		
FABACEAE - MIMOSOIDEAE	*Acacia mearnsii*	black wattle																		
FABACEAE - MIMOSOIDEAE	*Acacia obtusata*																			
FABACEAE - MIMOSOIDEAE	*Acacia stricta*	straight wattle																		
GERANIACEAE	*Geranium solanderi* var. *solanderi*	native geranium																2		
GERANIACEAE	*Geranium* prob. *solanderi* var. *solanderi*	native geranium																		
GERANIACEAE	*Geranium* sp.							2	2		2	2				2				
GOODENIACEAE	*Goodenia hederacea* subsp. *hederacea*	ivy goodenia																		
HALORAGACEAE	*Gonocarpus tetragynus*	a raspwort																2		
LAMIACEAE	*Ajuga australis*	Austral bugle																		
LAMIACEAE	**Stachys arvensis*	stagger weed																		
LORANTHACEAE	*Amyema pendulum* subsp. *pendulum*	drooping mistletoe															1			

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Family/Subfamily	*Scientific Name*	Common Name	Site 1	Site 2	Site 3	Site 4	Site 5	Site 6	Site 7	Site 8	Site 9	Site 10	Site 11	Site 12	Site 13	Site 14	Site 15	Site 16	Site 17	Site 18
MALVACEAE	*?Sida* sp.																	1		
MYRTACEAE	*Eucalyptus agglomerata*	blue-leaved stringybark			2		4	2	4	3	3	3	4	3		3				
MYRTACEAE	*Eucalyptus amplifolia* subsp. *amplifolia*	cabbage gum		5	3	2											3	2	2	
MYRTACEAE	*Eucalyptus blakelyi*	Blakely's red gum					1	2			2	2	2	2		2				
MYRTACEAE	*Eucalyptus bridgesiana*	apple box		4	2	2													2	
MYRTACEAE	*Eucalyptus cinerea*	Argyle apple		2	2			3				2								2
MYRTACEAE	*Eucalyptus dives*	broad-leaved peppermint						2		2										
MYRTACEAE	*Eucalyptus eugenioides*	thin-leaved stringybark																		
MYRTACEAE	*Eucalyptus globoidea*	white stringybark																		
MYRTACEAE	*Eucalyptus globoidea - eugenioides*																			
MYRTACEAE	*Eucalyptus goniocalyx*	bundy						2					2	2		2		2		
MYRTACEAE	*Eucalyptus macarthurii*	Camden woollybutt																		
MYRTACEAE	*Eucalyptus macrorhyncha*	red stringybark																		
MYRTACEAE	*Eucalyptus mannifera* subsp. *mannifera*	brittle gum																		2
MYRTACEAE	*Eucalyptus melliodora*	yellow box									3	2		2				2		2
MYRTACEAE	*Eucalyptus moluccana*	grey box																		
MYRTACEAE	*Eucalyptus ovata*	swamp gum		2	2	2														
MYRTACEAE	**Eucalyptus pseudoglobulus*	bastard eurabbie																		
MYRTACEAE	*Eucalyptus radiata*	narrow-leaved peppermint																		
MYRTACEAE	*Eucalyptus rossii*	inland scribbly gum																		
MYRTACEAE	*Kunzea parvifolia*									4										
MYRTACEAE	*Leptospermum polygalifolium*	yellow tea tree																		
MYRTACEAE	*Leptospermum* sp.																			
MYRTACEAE	*Leptospermum trinervium*	flaky-barked tea tree															1	1		
OXALIDACEAE	*Oxalis exilis*	a wood sorrel						2		2	2		2				1	2	2	
OXALIDACEAE	*Oxalis* sp.	a wood sorrel				2														
PHYTOLACCACEAE	**Phytolacca octandra*	inkweed			3															

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PITTOSPORACEAE	*Billardiera scandens*	appleberry																		
PITTOSPORACEAE	*Bursaria spinosa* subsp. *spinosa (syn. B. spinosa var. spinosa)*	blackthorn			1															
PLANTAGINACEAE	**Plantago lanceolata*	lambs' tongues			2	2														2
POLYGONACEAE	**Acetosella vulgaris*	sorrel	2			2											2		2	
POLYGONACEAE	**Polygonum aviculare*	wireweed															1			
POLYGONACEAE	*Rumex brownii*	swamp dock				2												2		2
POLYGONACEAE	**Rumex crispus*	curled dock			2															
PRIMULACEAE	**Anagallis arvensis*	scarlet pimpernell			2	2		3	2				2	2						
PROTEACEAE	*Grevillea ramosissima* subsp. *ramosissima*	fan grevillea																		
PROTEACEAE	*Persoonia linearis*	narrow-leaved geebung																		
RHAMNACEAE	*Cryptandra amara*	bitter cryptandra																		
RHAMNACEAE	*Pomaderris intermedia*																			
RHAMNACEAE	*Pomaderris lanigera ↔ andromedifolia*																			
ROSACEAE	*Acaena novae-zelandiae*	bidgee-widgee															1	2		
ROSACEAE	**Rosa rubiginosa*	sweet briar																1		
ROSACEAE	**Rubus fruitcosus* sp. *agg.*	blackberry				2												2	1	
RUBIACEAE	*?Galium propinquum*	Maori bedstraw																		
RUBIACEAE	*Opercularia diphylla*	stinkweed																		
RUBIACEAE	*Opercularia* sp.																			
RUBIACEAE	**Richardia stellaris*	field madder															1	2	1	
SANTALACEAE	*Exocarpos cupressiformis*	native cherry																		
SCROPHULARIACEAE	**Verbascum virgatum*	twiggy mullein																		
SCROPHULARIACEAE	*Veronica plebeia*	trailing speedwell																		
SOLANACEAE	**Lycium ferocissimum*	African boxthorn									3									
VERBENACEAE	**Verbena bonariensis*	purpletop																		

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Family/Subfamily	*Scientific Name*	Common Name	Site 19	Site 20	Site 21	Site 22	Site 23	Site 24	Site 25	Site 26	Site 27	Site 28	Site 29	Site 30	Site 31	Site 32	General
Filicopsida (Ferns)																	
ADIANTACEAE	*Cheilanthes sieberi* subsp. *sieberi*	poison rock fern					2				2						
AZOLLACEAE	*Azolla pinnata*																
Magnoliopsida (Flowering Plants) – Liliidae (Monocots)																	
ANTHERICACEAE	*Tricoryne elatior*	yellow autumn-lily															
CENTROLEPIDACEAE	*Centrolepis strigosa*																9
CYPERACEAE	*Baumea* sp.																
CYPERACEAE	*Carex appressa*	tall sedge															9
CYPERACEAE	*Carex breviculmis*	short-stem sedge															
CYPERACEAE	*Carex gaudichaudiana*																9
CYPERACEAE	**Cyperus aggregatus*																
CYPERACEAE	**Cyperus eragrostis*	umbrella sedge												2			
CYPERACEAE	*Cyperus* sp.												3				
CYPERACEAE	*Elaeocharis* sp.																9
CYPERACEAE	*Fimbristylis dichotoma*	common fringe-rush			1												
CYPERACEAE	*Fimbristylis* sp.	a fringe-rush															
CYPERACEAE	*Isolepis cernua*	nodding club-rush															9
CYPERACEAE	*Isolepis inundata*																9
CYPERACEAE	*Isolepis* sp.																
CYPERACEAE	*Lepidosperma filiforme*																9
CYPERACEAE	*Lepidosperma gunnii*	a sword-sedge				1		2			2			1			
CYPERACEAE	*Lepidosperma laterale*	variable saw-sedge															9
HALORAGACEAE	*Myriophyllum variifolium*																
JUNCACEAE	*Juncus australis*																
JUNCACEAE	**Juncus bufonius*	toad rush															9
JUNCACEAE	**Juncus capitatus*																9
JUNCACEAE	*Juncus planifolius*																9
JUNCACEAE	*Juncus sarophorus*																9
JUNCACEAE	*Juncus usitatus*	a rush	1		2											1	
JUNCACEAE	*Juncus usitatus X subsecundus*																9
JUNCACEAE	*Juncus* sp.	a sedge															

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Family/Subfamily	*Scientific Name*	Common Name	Site 19	Site 20	Site 21	Site 22	Site 23	Site 24	Site 25	Site 26	Site 27	Site 28	Site 29	Site 30	Site 31	Site 32	General
LOMANDRACEAE	*Lomandra confertifolia*					2	2				2				2		
LOMANDRACEAE	*Lomandra filiformis*	wattle mat-rush	1			1											
LOMANDRACEAE	*Lomandra filiformis* subsp. *coriacea*	wattle mat-rush															9
LOMANDRACEAE	*Lomandra longifolia*	spiny-headed mat-rush	2		2			1								2	9
LOMANDRACEAE	*Lomandra multiflora* subsp. *multiflora*	many-flowered mat-rush	3		2					2		2		2			
LOMANDRACEAE	*Lomandra obliqua*	twisted mat-rush				2										1	
ORCHIDACEAE	*Caladenia caerulea*	blue caladenia					1	1			1						
ORCHIDACEAE	*Diuris* sp.																
ORCHIDACEAE	*Microtis unifolia*	common onion orchid															9
ORCHIDACEAE	*Pterostylis* sp.	a greenhood									1						
PHORMIACEAE	*Dianella caerulea*	blue flax lily												3			
PHORMIACEAE	*Dianella* sp.	a blue flax lily															
PHORMIACEAE	*Stypandra glauca*	nodding blue lily					2	2	1						2		9
POACEAE	**Aira caryophyllea*	silvery hairgrass															9
POACEAE	*Aristida ramosa*	wire grass	1			1					2		2				
POACEAE	*Aristida ?ramosa*	wire grass														2	
POACEAE	*Austrodanthonia laevis (syn. Danthonia laevis)*	a wallaby grass		3				2	2	2		2			2	3	9
POACEAE	*Austrodanthonia racemosa (syn. Danthonia racemosa)*	white top															9
POACEAE	*Austrodanthonia racemosa* var. *racemosa (syn. Danthonia racemosa var. racemosa)*	white top			2	2	2				2						9
POACEAE	*Austrodanthonia setacea*																9
POACEAE	*Austrodanthonia tenuior (syn. Danthonia tenuior)*	a wallaby grass															9
POACEAE	*Austrodanthonia* sp.	a wallaby grass	2														
POACEAE	*Austrostipa densiflora*																9

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Family/Subfamily	*Scientific Name*	Common Name	Site 19	Site 20	Site 21	Site 22	Site 23	Site 24	Site 25	Site 26	Site 27	Site 28	Site 29	Site 30	Site 31	Site 32	General
POACEAE	*Austrostipa scabra* subsp. *falcata (syn. Stipa scabra ssp. falcata)*	speargrass															9
POACEAE	*Austrostipa scabra* subsp. *scabra (syn. Stipa scabra ssp. Scabra)*	corkscrew grass															
POACEAE	*Austrostipa* prob. *semibarbata*								1								
POACEAE	**Avena fatua*	wild oats															9
POACEAE	**Briza maxima*	quaking grass		2													
POACEAE	**Briza minor*	shivery grass															
POACEAE	**Bromus brevis*	a brome															9
POACEAE	**Bromus molliformis*	a soft brome															9
POACEAE	*Cynodon dactylon*	couch	2	2													9
POACEAE	*Dichelachne micrantha*	shorthair plumegrass															
POACEAE	*Echinopogon caespitosus* var. *caespitosus*	tufted hedgehog grass			2												
POACEAE	*Echinopogon* sp.	a hedgehog grass															9
POACEAE	**Eleusine tristachya*	goose grass											4				
POACEAE	*Elymus scaber*	wheatgrass															9
POACEAE	*Entolasia marginata*	bordered panic	2	3													
POACEAE	*Entolasia stricta*	wiry panic													2		
POACEAE	*Eragrostis brownii*	Brown's lovegrass															
POACEAE	**Festuca elatior*	tall fescue															9
POACEAE	**Holcus lanatus*	Yorkshire fog															9
POACEAE	*Lachnagrostis filiformis (syn. Agrostis avenacea var. avenacea)*	blown grass															9
POACEAE	**Lolium perenne*	perennial ryegrass															9
POACEAE	*Microlaena stipoides* var. *stipoides*	weeping grass		2													
POACEAE	*Panicum effusum*	hairy panic													2	2	
POACEAE	*Panicum ?effusum*	hairy panic			2												

Appendix A - Flora Species List

Family/Subfamily	*Scientific Name*	Common Name	Site 19	Site 20	Site 21	Site 22	Site 23	Site 24	Site 25	Site 26	Site 27	Site 28	Site 29	Site 30	Site 31	Site 32	General
POACEAE	*Panicum* sp.	a panic		2													
POACEAE	*Paspalum distichum*	saltwater couch															
POACEAE	**Pennisetum clandestinum*	kikuyu grass		2													
POACEAE	**Phalaris aquatica*	phalaris															
POACEAE	*Poa sieberiana*	snow grass															9
POACEAE	*Poa* sp.																
POACEAE	**Polypogon monspeliensis*	annual beardgrass															9
POACEAE	*Themeda australis*	kangaroo grass									1			4			9
POACEAE	**Vulpia bromoides*	squirrel tail fescue															9
POACEAE	**Vulpia myuros*	rat's tail fescue											2				9
XANTHORRHOEACEAE	*Xanthorrhoea glauca* subsp. *angustifolia*																9
Magnoliopsida (Flowering Plants) – Magnoliidae (Dicots)																	
APIACEAE	*Hydrocotyle laxiflora*	stinking pennywort															
ASTERACEAE	*Brachyscome* sp.																
ASTERACEAE	**Carthamus* sp.												2				
ASTERACEAE	*Cassinia arcuata*	sifton bush					2	1	2			2			2		9
ASTERACEAE	**Cirsium vulgare*	spear thistle															
ASTERACEAE	*?Cymbonotus lawsonianus*	bears-ear		1													
ASTERACEAE	*Euchiton* sp. (syn. Gnaphalium sp.)														1	1	
ASTERACEAE	**Gamochaeta calviceps*	cudweed															9
ASTERACEAE	**Gamochaeta* sp. *(syn. *Gnaphalium sp.)*	a cudweed		1													
ASTERACEAE	**Hypochaeris radicata*	catsear		2	2		1		1			1	2	2			
ASTERACEAE	*Olearia viscidula*	wallaby weed															
ASTERACEAE	**Onopordum acanthium*	scotch thistle		1										1	1		
ASTERACEAE	*Senecio quadridentatus*	cotton fireweed															9
ASTERACEAE	**Sonchus oleraceus*	common sowthistle															
ASTERACEAE	**Taraxacum officinale*	dandelion															

Appendix A - Flora Species List

Family/Subfamily	*Scientific Name*	Common Name	Site 19	Site 20	Site 21	Site 22	Site 23	Site 24	Site 25	Site 26	Site 27	Site 28	Site 29	Site 30	Site 31	Site 32	General
ASTERACEAE	*Vittadinia* sp.	a fuzzweed															9
BORAGINACEAE	**Echium plantagineum*	Paterson's curse															
BRASSICACEAE	**Brassica nigra*	black mustard												2			
BRASSICACEAE	**Lepidium africanum*	common peppercress															9
BRASSICACEAE	**Rapistrum rugosum*	turnip weed											2				
BRASSICACEAE	*Rorippa* sp.																
CAMPANULACEAE	*Wahlenbergia* sp.	native bluebell															
CARYOPHYLLACEAE	**Cerastium glomeratum*	mouse-ear chickweed												2			
CARYOPHYLLACEAE	**Paronychia brasiliana*	Chilean whitlow wort											1				
CARYOPHYLLACEAE	**Petrorhagia nanteuilii*	proliferous pink															
CASUARINACEAE	*Allocasuarina littoralis*	black sheoak						2	2	4	2	2			2		9
CHENOPODIACEAE	*Einadia nutans*	climbing saltbush															
CHENOPODIACEAE	*Einadia trigonos*	fishweed			2												
CHENOPODIACEAE	*Einadia* sp.	a saltbush															
DILLENIACEAE	*Hibbertia obtusifolia* complex	hoary guinea flower					2	2				2			2		9
DILLENIACEAE	*Hibbertia* sp.	a Guinea flower				1											
DROSERACEAE	*Drosera peltata*																
EPACRIDACEAE	*Leucopogon muticus*	blunt beard-heath					1										
EPACRIDACEAE	*Leucopogon* sp.																
EPACRIDACEAE	*Lissanthe strigosa*	peach heath	2	2	2		1	1	2	2	2	2			1	2	9
EPACRIDACEAE	*Melichrus erubescens*	ruby urn heath					2		1	1	2				1		
EPACRIDACEAE	*Melichrus urceolatus*	urn heath															
EUPHORBIACEAE	*Phyllanthus virgatus*	a spurge														2	
EUPHORBIACEAE	*Phyllanthus* sp.	a spurge				1											
EUPHORBIACEAE	*Poranthera microphylla*	small poranthera					1										9
FABACEAE - FABOIDEAE	*Glycine* sp.	a glycine															
FABACEAE - FABOIDEAE	*Hardenbergia violacea*	false sarsaparilla										2					
FABACEAE - FABOIDEAE	*Hovea heterophylla*											2					
FABACEAE - FABOIDEAE	**Medicago* sp.	a medic															
FABACEAE - FABOIDEAE	**Trifolium arvense*	haresfoot clover															9

Appendix A - Flora Species List

Family/Subfamily	*Scientific Name*	Common Name	Site 19	Site 20	Site 21	Site 22	Site 23	Site 24	Site 25	Site 26	Site 27	Site 28	Site 29	Site 30	Site 31	Site 32	General
FABACEAE - FABOIDEAE	**Trifolium campestre*	hop clover															9
FABACEAE - FABOIDEAE	**Trifolium glomeratum*	clustered clover															9
FABACEAE - FABOIDEAE	**Trifolium repens*	white clover															
FABACEAE - FABOIDEAE	**Trifolium* sp.	a clover											2				
FABACEAE - FABOIDEAE	**Trifolium subterraneum*	subterranean clover															9
FABACEAE - MIMOSOIDEAE	*Acacia amblygona*	fan wattle														1	9
FABACEAE - MIMOSOIDEAE	*Acacia brownii*	prickly Moses															9
FABACEAE - MIMOSOIDEAE	*Acacia cultriformis*	knife-leaved wattle															9
FABACEAE - MIMOSOIDEAE	*Acacia decurrens*	black wattle		2			1		1								9
FABACEAE - MIMOSOIDEAE	*Acacia genistifolia*	early wattle										2	1				
FABACEAE - MIMOSOIDEAE	*Acacia gunnii*	ploughshare wattle									1	1					
FABACEAE - MIMOSOIDEAE	*Acacia mearnsii*	black wattle															9
FABACEAE - MIMOSOIDEAE	*Acacia obtusata*															2	
FABACEAE - MIMOSOIDEAE	*Acacia stricta*	straight wattle												2			9
GERANIACEAE	*Geranium solanderi* var. *solanderi*	native geranium		2	1												
GERANIACEAE	*Geranium* prob. *solanderi* var. *solanderi*	native geranium											2				
GERANIACEAE	*Geranium* sp.						2										
GOODENIACEAE	*Goodenia hederacea* subsp. *hederacea*	ivy goodenia					2	1	2		1	1			2	2	9
HALORAGACEAE	*Gonocarpus tetragynus*	a raspwort		2	1		2		1		2	2			1	2	
LAMIACEAE	*Ajuga australis*	Austral bugle												1			
LAMIACEAE	**Stachys arvensis*	stagger weed												1			
LORANTHACEAE	*Amyema pendulum* subsp. *pendulum*	drooping mistletoe		2													

Appendix A - Flora Species List

Family/Subfamily	*Scientific Name*	Common Name	Site 19	Site 20	Site 21	Site 22	Site 23	Site 24	Site 25	Site 26	Site 27	Site 28	Site 29	Site 30	Site 31	Site 32	General
MALVACEAE	*?Sida* sp.																
MYRTACEAE	*Eucalyptus agglomerata*	blue-leaved stringybark				2	4	3	4	4	1	3					9
MYRTACEAE	*Eucalyptus amplifolia* subsp. *amplifolia*	cabbage gum		3	3												9
MYRTACEAE	*Eucalyptus blakelyi*	Blakely's red gum															9
MYRTACEAE	*Eucalyptus bridgesiana*	apple box		2	2												9
MYRTACEAE	*Eucalyptus cinerea*	Argyle apple	3	2								2					9
MYRTACEAE	*Eucalyptus dives*	broad-leaved peppermint															9
MYRTACEAE	*Eucalyptus eugenioides*	thin-leaved stringybark															9
MYRTACEAE	*Eucalyptus globoidea*	white stringybark															9
MYRTACEAE	*Eucalyptus globoidea - eugenioides*																9
MYRTACEAE	*Eucalyptus goniocalyx*	bundy						2		2		3					
MYRTACEAE	*Eucalyptus macarthurii*	Camden woollybutt															9
MYRTACEAE	*Eucalyptus macrorhyncha*	red stringybark	2	2	2	3									4	2	9
MYRTACEAE	*Eucalyptus mannifera* subsp. *mannifera*	brittle gum		2													
MYRTACEAE	*Eucalyptus melliodora*	yellow box			2												
MYRTACEAE	*Eucalyptus moluccana*	grey box			2												9
MYRTACEAE	*Eucalyptus ovata*	swamp gum															9
MYRTACEAE	**Eucalyptus pseudoglobulus*	bastard eurabbie															9
MYRTACEAE	*Eucalyptus radiata*	narrow-leaved peppermint	2														9
MYRTACEAE	*Eucalyptus rossii*	inland scribbly gum	3			2						2			2	2	
MYRTACEAE	*Kunzea parvifolia*										5	1					9
MYRTACEAE	*Leptospermum polygalifolium*	yellow tea tree															9
MYRTACEAE	*Leptospermum* sp.																9
MYRTACEAE	*Leptospermum trinervium*	flaky-barked tea tree					1			3							9
OXALIDACEAE	*Oxalis exilis*	a wood sorrel		2					1				2				
OXALIDACEAE	*Oxalis* sp.	a wood sorrel															
PHYTOLACCACEAE	**Phytolacca octandra*	inkweed															9

Appendix A - Flora Species List

Family/Subfamily	*Scientific Name*	Common Name	Site 19	Site 20	Site 21	Site 22	Site 23	Site 24	Site 25	Site 26	Site 27	Site 28	Site 29	Site 30	Site 31	Site 32	General
PITTOSPORACEAE	*Billardiera scandens*	appleberry				1											
PITTOSPORACEAE	*Bursaria spinosa* subsp. *spinosa (syn. B. spinosa var. spinosa)*	blackthorn															9
PLANTAGINACEAE	**Plantago lanceolata*	lambs' tongues		1	2								2	2			
POLYGONACEAE	**Acetosella vulgaris*	sorrel											2	2	1		
POLYGONACEAE	**Polygonum aviculare*	wireweed															
POLYGONACEAE	*Rumex brownii*	swamp dock											1				9
POLYGONACEAE	**Rumex crispus*	curled dock															
PRIMULACEAE	**Anagallis arvensis*	scarlet pimpernell															
PROTEACEAE	*Grevillea ramosissima* subsp. *ramosissima*	fan grevillea										2					
PROTEACEAE	*Persoonia linearis*	narrow-leaved geebung				1											
RHAMNACEAE	*Cryptandra amara*	bitter cryptandra						1									
RHAMNACEAE	*Pomaderris intermedia*																9
RHAMNACEAE	*Pomaderris lanigera ↔ andromedifolia*							1									
ROSACEAE	*Acaena novae-zelandiae*	bidgee-widgee											2				
ROSACEAE	**Rosa rubiginosa*	sweet briar															
ROSACEAE	**Rubus fruitcosus* sp. *agg.*	blackberry		2	2									1			9
RUBIACEAE	*?Galium propinquum*	Maori bedstraw		1													
RUBIACEAE	*Opercularia diphylla*	stinkweed				1											
RUBIACEAE	*Opercularia* sp.			1			1										
RUBIACEAE	**Richardia stellaris*	field madder											2				
SANTALACEAE	*Exocarpos cupressiformis*	native cherry			1												9
SCROPHULARIACEAE	**Verbascum virgatum*	twiggy mullein												2			
SCROPHULARIACEAE	*Veronica plebeia*	trailing speedwell													1		
SOLANACEAE	**Lycium ferocissimum*	African boxthorn															
VERBENACEAE	**Verbena bonariensis*	purpletop												1			

APPENDIX B

Fauna Species List

Appendix B – Fauna Species List

Scientific Name	Common Name	Conservation Status		Sites							
		TSC Act	EPBC Act	November 2003	June 2004	September 2004					
						1	2	3	4	5	Opportunistic
BIRDS											
Anatidae											
Chenonetta jubata	Australian wood duck		M	X	X						31,49,25,24,30,36,43
Anas superciliosa	Pacific black duck		M	X							39,54
Anas gracilis	grey teal		M	X							24,30,39,51
Podicipedidae											
Tachybaptus novaehollandiae	Australasian grebe			X							24,48
Ardeidae											
Egretta novaehollandiae	white-faced heron			X							21
Threskiornithidae											
Threskiornis spinicollis	straw-necked ibis			X							
Accipitridae											
Accipiter fasciatus	brown goshawk		M					X			
Aquila audax	wedge-tailed eagle		M								23
Falconidae											
Falco longipennis	Australian hobby		M								44
Falco cenchroides	nankeen kestrel		M	X							24
Columbidae											
Phaps chalcoptera	common bronzewing			X							16
Ocyphaps lophotes	crested pigeon			X							24
Cacatuidae											
Calyptorhynchus funereus	yellow-tailed black-cockatoo			X							

Scientific Name	Common Name	Conservation Status		Sites							
		TSC Act	EPBC Act	November 2003	June 2004	September 2004					
						1	2	3	4	5	Opportunistic
Cacatua roseicapilla	galah			X	X	X					38
Cacatua tenuirostris	long-billed corella			X							
Psittacidae											
Platycercus elegans	crimson rosella			X	X	X			X		24,42
Platycercus eximius	eastern rosella			X		X	X				27,31,55,25,49,24
Psephotus haematonotus	red-rumped parrot										24,42
Psephotus varius	mulga parrot			X							
Cuculidae											
Chrysococcyx basalis	Horsfield's bronze-cuckoo										28
Strigidae											
Ninox novaeseelandiae	southern boobook			X							12
Aegothelidae											
Aegotheles cristatus	Australian owlet-nightjar			X							
Halcyonidae											
Dacelo novaeguineae	laughing kookaburra					X					48,13
Climacteridae											
Corombates leucophaeus	white-throated treecreeper			X	X			X	X		50,21
Maluridae											
Petroica rosea	Rose Robin										50,44
Malurus cyaneus	superb fairy-wren			X				X			28,50
Pardalotidae											
Pardalotus striatus	striated pardalote					X			X		50,42
Pyrrholaemus sagittata	speckled warbler	V		X							

Scientific Name	Common Name	Conservation Status		Sites							
		TSC Act	EPBC Act	November 2003	June 2004	September 2004					
						1	2	3	4	5	Opportunistic
Gerygone olivacea	white-throated gerygone			X							
Acanthiza pusilla	Brown Thornbill			X				X			
Acanthiza reguloides	buff-rumped thornbill			X				X	X		50,42,21
Acanthiza chrysorrhoa	yellow-rumped thornbill			X	X	X		X			13,28,13,44,50, 55,48,49,42,21
Acanthiza nana	yellow thornbill			X				X			
Acanthiza lineata	striated thornbill					X		X	X		37,42,21
Meliphagidae											
Anthochaera carunculata	red wattlebird										17,21,24,50,42,44
Anthochaera chrysoptera	little wattlebird			X							
Philemon corniculatus	noisy friarbird			X							44
Manorina melanocephala	noisy miner			X	X		X			X	24,55,27,26,31,42
Lichenostomus chrysops	yellow-faced honeyeater			3	X				X	X	54,28,50,42
Lichenostomus leucotis	white-eared honeyeater										7
Melithreptus brevirostris	brown-headed honeyeater										42
Melithreptus lunatus	white-naped honeyeater										42
Acanthorhynchus tenuirostris	eastern spinebill			X							17
Petroicidae											
Petroica multicolor	scarlet robin			X	X			X	X		43

Scientific Name	Common Name	Conservation Status		Sites							
		TSC Act	EPBC Act	November 2003	June 2004	September 2004					
						1	2	3	4	5	Opportunistic
Petroica rosea	rose robin							X			
Neosittidae											
Daphoenositta chrysoptera	varied sittella								X		
Pachycephalidae											
Pachycephala pectoralis	golden whistler					X		X			50,42,44
Colluricincla harmonica	grey shrike-thrush			X				X	X		50,42
Dicruridae											
Myiagra rubecula	leaden flycatcher			X							
Grallina cyanoleuca	magpie-lark			X	X						27,37,24,42
Rhipidura fuliginosa	grey fantail			X	X	X			X	X	28,21,44,38,50, 42,41
Rhipidura leucophrys	willie wagtail			X		X					28,44,38,39,43, 54,42,21
Campephagidae											
Coracina novaehollandiae	black-faced cuckoo-shrike			X	X	X	X				43,21,44
Lalage sueurii	white-winged triller										42
Artamidae											
Artamus cyanopterus	dusky woodswallow										28,42
Cracticus nigrogularis	pied butcherbird			X							
Gymnorhina tibicen	Australian magpie			X	X	X	X	X	X		44,27,13,14,21,25, 24,31,37,55,50,32, 38,48,49,42
Strepera graculina	pied currawong			X	X			X			13,50,38,24,44
Strepera versicolor	grey currawong			X							50
Corvidae											

Scientific Name	Common Name	Conservation Status		Sites							
		TSC Act	EPBC Act	November 2003	June 2004	September 2004					
						1	2	3	4	5	Opportunistic
Corvus coronoides	Australian raven			X	X	X				X	
Corcoracidae											
Corcorax melanorhamphos	white-winged chough			X		X	X	X			27,14,24
Alaudidae											
**Alauda arvensis*	skylark										49
Motacilidae											
Anthus novaeseelandiae	Richard's pipit										49,28,54,39,43
Passeridae											
Neochmia temporalis	red-browed finch			X							28
Hirundinidae											
Hirundo neoxena	welcome swallow			X			X				
Hirundo ariel	fairy martin			X						X	
Zosteropidae											
Zosterops lateralis	silvereye									X	
Sturnidae											
**Sturnus vulgaris*	common starling			X							23,21,24
**Acridotheres tristis*	common myna			X							24
REPTILES											
Cheloniidae											
Chelodina longicollis	snake-necked turtle									X	36,39,54,51
Agamidae											
Pogona barbata	eastern bearded dragon			X							
Scincidae											
Ctenotus taeniolatus	copper-tailed skink							X			
Egernia major	land mullet			X							

Scientific Name	Common Name	Conservation Status		Sites							
		TSC Act	EPBC Act	November 2003	June 2004	September 2004					
						1	2	3	4	5	Opportunistic
Egernia whitii	White's skink			X							
Lampropholis delicata	grass skink			X							
Lampropholis guichenoti	garden skink							X			
Pseudechis porphyriacus	red-bellied black snake			X							
Tiliqua scincoides	eastern blue-tongued lizard			X							
AMPHIBIANS											
Myobatrachidae											
Litoria fallax	eastern dwarf tree frog			X							
Litoria peronii	Peron's tree frog			X							
Crinia parinsignifera	brown froglet					X					39,51
Crinia signifera	brown froglet										14,21,24,43,39, 48,54,49,51
Limnodynastes tasmaniensis	spotted marsh frog			X							
Uperoleia laevigata	smooth toadlet										39,48,51
MAMMALS											
Tachyglossidae											
Tachyglossus aculeatus	short-beaked echidna										39
Dasyuridae											
Antechinus stuartii	brown antechinus					X					
Antechinus flavipes	yellow-footed antechinus			X							
Vombatidae											
Vombatus ursinus	common wombat			X	X				X		24,13,51

Scientific Name	Common Name	Conservation Status		Sites							
		TSC Act	EPBC Act	November 2003	June 2004	September 2004					
						1	2	3	4	5	Opportunistic
Petauridae											
Petaurus breviceps	sugar glider			X	X						
Petaurus norfolcensis	squirrel glider	V		X							
Pseudocheiridae											
Pseudocheirus peregrinus	common ringtail possum										42,43,21,44,45
Phalangeridae											
Trichosurus vulpecula	common brushtail possum			X	X	X	X		X		32,24,44,13,42,14, 38,50
Macropodidae											
Macropus giganteus	eastern grey kangaroo			X	X	X				X	43,48,13,25,31,37, 53,21,28,7,38,36,39, 44,51,49
Macropus robustus	common wallaroo										48,38
Wallabia bicolor	swamp wallaby			X							
Vespertilionidae											
Chalinolobus gouldii	Gould's wattled bat			P							24 (C)
Chalinolobus morio	chocolate wattled bat			P							24 (P)
Falsistrellus tasmaniensis	eastern false pipistrelle	V		PO							24 (PO)
Miniopterus schreibersii oceanensis	eastern bentwing-bat	V		C							24 (P)
Mormopterus norfolkensis	eastern freetail-bat	V		PO							24 (PO)
Scotorepens orion	eastern broad-nosed bat										24 (C)
Vespadelus darlingtoni	large forest bat			C							24 (P)

Scientific Name	Common Name	Conservation Status		Sites							
		TSC Act	EPBC Act	November 2003	June 2004	September 2004					
						1	2	3	4	5	Opportunistic
Vespadelus regulus	southern forest bat			P							
Vespadelus vulturnus	little forest bat			P							
Muridae											
**Rattus rattus*	black rat			X							
Canidae											
Canis lupus dingo	dingo			X							
**Vulpes vulpes*	fox			X					X		24,38,36
Felidae											
**Felis catus*	cat			X							32
Bovidae											
**Bos taurus*	*Cattle			X							
Leporidae											
**Oryctolagus cuniculus*	rabbit			X			X				44
**Lepus capensis*	brown hare			X							21,36,48,49

Legend:

X = species recorded in study area.
C = ‘confident’ echolocation identification by Fly By Night Bat Surveys Pty Ltd.
P = ‘probable’ echolocation identification by Fly By Night Bat Surveys Pty Ltd.
PO = ‘possible’ echolocation identification by Fly By Night Bat Surveys Pty Ltd.
Opportunistic = 500 by 500 metre grid system covering the entire project area in which opportunistic sightings were recorded (refer to Figure A – this appendix).
M = Listed migratory species
V = Vulnerable species

Umwelt Environmental Consultants

Base Source: LPI 2004, Readymix Holdings Pty Ltd (Aerial Photo March 2005)

0 0.25 0.5 1km

Legend

Project Area

FIGURE A

Opportunistic Sighting Grid

APPENDIX C

Section 5A Threatened Species Assessment

Appendix C

Section 5A Threatened Species Assessment

A search of the DEC Atlas of NSW Wildlife for all threatened species occurring within the vicinity of the project area was undertaken, with the results of the search included in Tables 3.1 and 3.4 of the main text. Of the ten threatened flora species recorded on these database searches, the project area was considered to provide potential habitat for six species. In addition, one species (*Eucalyptus macarthurii*), for which the NSW Scientific Committee has made a preliminary determination to list as a vulnerable species, has been included in this assessment.

Of the 32 fauna species recorded, 19 were considered to potentially utilise the resources of the study area. Full assessment under Section 5A of the *Environmental Planning and Assessment* (EPA Act) *Act 1979* is required for these 18 species, and is provided in the following sections, as well as an assessment of *Eucalyptus macarthurii*.

1) *Pomaderris cotoneaster*

Pomaderris cotoneaster is an uncommon small shrub with cream flowers on short leaf panicles (Harden 2000b). It grows in dry sclerophyll forests, often on skeletal soils in the ranges south from the Moss Vale district and into Victoria (Harden 2000b).

a) In the case of a threatened species, whether the life cycle of the species is likely to be disrupted such that a viable population of the species is likely to be placed at risk of extinction.

Although not recorded in the project area, it is possible that *Pomaderris cotoneaster* could be present. Extensive searches across the project area did not locate it, despite the recording of two other *Pomaderris* species. If any specimens were present, it is likely that they would form only a small subpopulation. Therefore, it is unlikely that the project would place a viable population at risk of extinction.

b) In the case of an endangered population, whether the lifecycle of the species that constitutes the endangered population is likely to be disrupted such that the viability of the population is likely to be significantly compromised.

No endangered populations of *Pomaderris cotoneaster* are recorded in the project area.

c) In relation to the regional distribution of the habitat of a threatened species, population or ecological community, whether a significant area of known habitat is to be modified or removed.

Pomaderris cotoneaster has not been recorded in the project area and is not known to occur. A significant area of known habitat for this species will not be modified by the project.

d) Whether an area of known habitat is likely to become isolated from currently interconnecting or proximate areas for a threatened species population or ecological community.

The project area is not known habitat for *Pomaderris cotoneaster*. There is, however, potential habitat for this species in the project area. The project will require the removal of native vegetation within the project area, however given that the project will take place in a landscape that is already highly fragmented, it is unlikely that it will result in an area of potential habitat becoming isolated from currently interconnecting or proximate areas of habitat for the species.

e) Whether critical habitat will be affected.

No areas of critical habitat are present within the project area. There will be no loss of critical habitat for any threatened species, populations or ecological communities as a result of the project.

f) Whether a threatened species, population or ecological community, or their habitats are adequately represented in conservation reserves (or other similar protected areas) in the region.

It is not known if *Pomaderris cotoneaster* is adequately represented in conservation reserves in the region. There are no known records of the species from local conservation reserves.

g) Whether the development or activity proposed is of a class of development or activity that is recognised as a threatening process.

Those Key Threatening Processes currently listed under Schedule 3 of the TSC Act 1995 with the potential to be relevant to this project include: clearing of native vegetation; bushrock removal; alteration to the natural flow regimes of rivers, streams, floodplains & wetlands; and removal of dead wood and dead trees.

h) Whether any threatened species, population or ecological community is at the limit of its known distribution.

The project area is not at the limit of the known distribution of *Pomaderris cotoneaster*.

2) Buttercup Doubletail - *Diuris aequalis*

This species was not recorded in the project area. It is known from fewer than 20 small and fragmented populations between Braidwood and the Blue Mountains in the Central and Southern Tablelands of NSW (Jones 1993a). Although not recorded in the project area, it is possible that it may be present, based on the type of habitat it is known to occupy and its current known distribution. It is recorded as occupying grassy areas in sclerophyll forest and is known to flower between October and December (Jones 1993a). Two week-long flora surveys were conducted during the flowering period of the species, however it was not detected. This may be because the species is not present, but may also be due to a combination of a low likelihood of detection because of the species' cryptic nature, or because the prolonged drought occurring at the time prevented the species from flowering at those times.

a) In the case of a threatened species, whether the life cycle of the species is likely to be disrupted such that a viable population of the species is likely to be placed at risk of extinction.

Although not recorded in the project area, it is possible that *Diuris aequalis* could be present. However, given the extent of surveys across the project area, it is likely that any specimens present would form only a small subpopulation. Therefore, it is unlikely that the project would place a viable population at risk of extinction.

b) In the case of an endangered population, whether the lifecycle of the species that constitutes the endangered population is likely to be disrupted such that the viability of the population is likely to be significantly compromised.

No endangered populations of *Diuris aequalis* are recorded in the project area.

c) In relation to the regional distribution of the habitat of a threatened species, population or ecological community, whether a significant area of known habitat is to be modified or removed.

Diuris aequalis has not been recorded in the project area and is not known to occur there. A significant area of known habitat for this species will not therefore be modified by the project.

d) Whether an area of known habitat is likely to become isolated from currently interconnecting or proximate areas for a threatened species population or ecological community.

The project area is not known habitat for *Diuris aequalis*. There is, however potential habitat for this species in the project area. The project will require the removal of native vegetation within the project area, however given that the landscape is already highly fragmented, it is unlikely that it will result in an area of potential habitat becoming isolated from currently interconnecting or proximate areas of habitat for the species.

e) Whether critical habitat will be affected.

No areas of critical habitat are present within the project area. There will be no loss of critical habitat for any threatened species, population or ecological community as a result of the project.

f) Whether a threatened species, population or ecological community, or their habitats are adequately represented in conservation reserves (or other similar protected areas) in the region.

It is not known if *Diuris aequalis* is adequately represented in conservation reserves in the region.

g) Whether the development or activity proposed is of a class of development or activity that is recognised as a threatening process.

Those Key Threatening Processes currently listed under Schedule 3 of the TSC Act 1995 with the potential to be relevant to this project include: clearing of native vegetation; bushrock removal; alteration to the natural flow regimes of rivers, streams, floodplains & wetlands; and removal of dead wood and dead trees.

h) Whether any threatened species, population or ecological community is at the limit of its known distribution.

The project area is near the limit of the known distribution of *Diuris aequalis*, however, the species was not recorded in the project area.

3) Tricolour Orchid - *Diuris tricolor*

Diuris tricolor is a small terrestrial orchid that flowers between September and November and grows among grass in sclerophyll woodland, often with *Callitris* (Jones 1993a). Two week-long flora surveys were conducted during the flowering period of the species, however it was not detected. This may be because the species is not present, but may also be due to a combination of a low likelihood of detection because of the species' cryptic nature, or because the prolonged drought occurring at the time prevented the species from flowering at those times.

a) In the case of a threatened species, whether the life cycle of the species is likely to be disrupted such that a viable population of the species is likely to be placed at risk of extinction.

Although not recorded in the project area, it is possible that *Diuris tricolor* could be present. However, given the extent of surveys across the project area, it is likely that any specimens present would form only a small subpopulation. Therefore, it is unlikely that the project would place a viable population at risk of extinction.

b) In the case of an endangered population, whether the lifecycle of the species that constitutes the endangered population is likely to be disrupted such that the viability of the population is likely to be significantly compromised.

No endangered populations of this species are recorded in the project area.

c) In relation to the regional distribution of the habitat of a threatened species, population or ecological community, whether a significant area of known habitat is to be modified or removed.

Diuris tricolor has not been recorded in the project area and is not known to occur there. A significant area of known habitat for this species will not be modified by the project.

d) Whether an area of known habitat is likely to become isolated from currently interconnecting or proximate areas for a threatened species population or ecological community.

The project area is not known habitat for *Diuris tricolor*. There is, however potential habitat for this species in the project area. The project will require the removal of native vegetation within the project area, however given that the landscape is already highly fragmented, it is unlikely that it will result in an area of potential habitat becoming isolated from currently interconnecting or proximate areas of habitat for the species.

e) Whether critical habitat will be affected.

No areas of critical habitat are present within the project area. There will be no loss of critical habitat for any threatened species, populations or ecological communities as a result of the project.

f) Whether a threatened species, population or ecological community, or their habitats are adequately represented in conservation reserves (or other similar protected areas) in the region.

It is not known if *Diuris tricolor* is adequately represented in conservation reserves in the region. Given its preference for open, semi-disturbed woodlands and grasslands, it is likely that it is not adequately represented, because such ecosystems occur in their majority on private land.

g) Whether the development or activity proposed is of a class of development or activity that is recognised as a threatening process.

Those Key Threatening Processes currently listed under Schedule 3 of the TSC Act 1995 with the potential to be relevant to this project include: clearing of native vegetation; bushrock removal; alteration to the natural flow regimes of rivers, streams, floodplains & wetlands; and removal of dead wood and dead trees.

h) Whether any threatened species, population or ecological community is at the limit of its known distribution.

The project area is not at the limit of the known distribution of *Diuris tricolor*.

4) Plumed Midge-orchid - *Genoplesium plumosum*

Genoplesium plumosum is a small terrestrial orchid, 10-20 centimetres high, that flowers from December to March (Jones 1993b). Its habitat is dry sclerophyll forest and it also occurs in moss gardens over sandstone sheets (Jones 1993b). Two week-long flora surveys were conducted during the flowering period of the species, however it was not detected. This may be because the species is not present, but may also be due to a combination of a low likelihood of detection because of the species' cryptic nature, or because the prolonged drought occurring at the time prevented the species from flowering at those times.

a) In the case of a threatened species, whether the life cycle of the species is likely to be disrupted such that a viable population of the species is likely to be placed at risk of extinction.

Although not recorded in the project area, it is possible that *Genoplesium plumosum* could be present. However, given the extent of surveys across the project area, it is likely that any specimens present would form only a small subpopulation. Therefore, it is unlikely that the project would place a viable population at risk of extinction.

b) In the case of an endangered population, whether the lifecycle of the species that constitutes the endangered population is likely to be disrupted such that the viability of the population is likely to be significantly compromised.

No endangered populations of this species are recorded in the project area.

c) In relation to the regional distribution of the habitat of a threatened species, population or ecological community, whether a significant area of known habitat is to be modified or removed.

Genoplesium plumosum has not been recorded in the project area and is not known to occur there. A significant area of known habitat for this species will not be modified by the project.

d) Whether an area of known habitat is likely to become isolated from currently interconnecting or proximate areas for a threatened species population or ecological community.

The project area is not known habitat for *Genoplesium plumosum*. There is, however potential habitat for this species in the project area. The project will require the removal of native vegetation within the project area, however given that the landscape is already highly fragmented, it is unlikely that it will result in an area of potential habitat becoming isolated from currently interconnecting or proximate areas of habitat for the species.

e) Whether critical habitat will be affected.

No areas of critical habitat are present within the project area. There will be no loss of critical habitat for any threatened species, populations or ecological communities as a result of the project.

f) Whether a threatened species, population or ecological community, or their habitats are adequately represented in conservation reserves (or other similar protected areas) in the region.

It is not known if *Genoplesium plumosum* is adequately represented in conservation reserves in the region.

g) Whether the development or activity proposed is of a class of development or activity that is recognised as a threatening process.

Those Key Threatening Processes currently listed under Schedule 3 of the TSC Act 1995 with the potential to be relevant to this project include: clearing of native vegetation; bushrock removal; alteration to the natural flow regimes of rivers, streams, floodplains & wetlands; and removal of dead wood and dead trees.

h) Whether any threatened species, population or ecological community is at the limit of its known distribution.

The project area is at the limit of the known distribution of *Genoplesium plumosum* as it is recorded by Jones (1993b) as occurring between Port Jackson and Marulan.

5) *Kunzea cambagei*

Kunzea cambagei is a prostrate or ascending shrub to 0.6 metres high, with cream to yellowish flowers which are present in spring (Wilson 2002b). It is mainly recorded from heath and is known mainly from Mt Werong and Berrima (Wilson 2002b). Two week-long flora surveys were conducted during the flowering period of the species, however it was not detected. This may be as the species is not present or because of the prolonged drought occurring at the time prevented the species from flowering at those times.

a) In the case of a threatened species, whether the life cycle of the species is likely to be disrupted such that a viable population of the species is likely to be placed at risk of extinction.

Although not recorded in the project area, it is possible that *Kunzea cambagei* could be present, although the project area lacks the heath habitats preferred by this species. However, given the extent of surveys across the project area, it is likely that any specimens present would form only a small subpopulation. Therefore, it is unlikely that the project would place a viable population at risk of extinction.

b) In the case of an endangered population, whether the lifecycle of the species that constitutes the endangered population is likely to be disrupted such that the viability of the population is likely to be significantly compromised.

No endangered populations of this species are recorded in the project area.

c) In relation to the regional distribution of the habitat of a threatened species, population or ecological community, whether a significant area of known habitat is to be modified or removed.

Kunzea cambagei has not been recorded in the project area and is not known to occur there. A significant area of known habitat for this species will not be modified by the project.

d) Whether an area of known habitat is likely to become isolated from currently interconnecting or proximate areas for a threatened species population or ecological community.

The project area is not known habitat for *Kunzea cambagei*. There is, however, potential habitat for this species in the project area. The project will require the removal of native vegetation within the project area, however given that the landscape is already highly fragmented, it is unlikely that the project will result in an area of potential habitat becoming isolated from currently interconnecting or proximate areas of potential habitat for the species.

e) Whether critical habitat will be affected.

No areas of critical habitat are present within the project area. There will be no loss of critical habitat for any threatened species, populations or ecological communities as a result of the project.

f) Whether a threatened species, population or ecological community, or their habitats are adequately represented in conservation reserves (or other similar protected areas) in the region.

It is not known if *Kunzea cambagei* is adequately represented in conservation reserves in the region.

g) Whether the development or activity proposed is of a class of development or activity that is recognised as a threatening process.

Those Key Threatening Processes currently listed under Schedule 3 of the TSC Act 1995 with the potential to be relevant to this project include: clearing of native vegetation; bushrock removal; alteration to the natural flow regimes of rivers, streams, floodplains & wetlands; and removal of dead wood and dead trees.

h) Whether any threatened species, population or ecological community is at the limit of its known distribution.

The project area is at the known limit of this species, however, as discussed above, the species is not known to occur in the project area.

6) *Thesium australe*

Thesium australe is an erect perennial herb to 40 cm, flowering in spring and summer (Wiecek 1992). It often prefers moist environments, typically in woodland or grassland, occurring infrequently across its range throughout much of eastern NSW (Wiecek 1992). Two week-long flora surveys were conducted during the flowering period of the species, however it was not detected. This may be because it is not present or may be due to a combination of a low likelihood of detection because of the species' cryptic nature, or because the prolonged drought occurring at the time prevented the species from flowering at those times.

a) In the case of a threatened species, whether the life cycle of the species is likely to be disrupted such that a viable population of the species is likely to be placed at risk of extinction.

Although not recorded in the project area, it is possible that *Thesium australe* could be present. However, given the extent of surveys across the project area, it is likely that any specimens present would form only a small subpopulation. Therefore, it is unlikely that the project would place a viable population at risk of extinction.

b) In the case of an endangered population, whether the lifecycle of the species that constitutes the endangered population is likely to be disrupted such that the viability of the population is likely to be significantly compromised.

No endangered populations of this species are recorded in the project area.

c) In relation to the regional distribution of the habitat of a threatened species, population or ecological community, whether a significant area of known habitat is to be modified or removed.

Thesium australe has not been recorded in the project area and is not known to occur there. A significant area of known habitat for this species will not be modified by the project.

d) Whether an area of known habitat is likely to become isolated from currently interconnecting or proximate areas for a threatened species population or ecological community.

The project area is not known habitat for *Thesium australe*. There is, however potential habitat for this species in the project area. The project will require the removal of native vegetation within the project area, however, given that the landscape is already highly fragmented, it is unlikely that the project will result in an area of potential habitat becoming isolated from currently interconnecting or proximate areas of potential habitat for the species.

e) Whether critical habitat will be affected.

No areas of critical habitat are present within the project area. There will be no loss of critical habitat for any threatened species, population or ecological community as a result of the project.

f) Whether a threatened species, population or ecological community, or their habitats are adequately represented in conservation reserves (or other similar protected areas) in the region.

It is not known if *Kunzea cambagei* is adequately represented in conservation reserves in the region. Given its likely preference for woodlands and grasslands, it is likely that it is not adequately represented, because such ecosystems occur in their majority on private land.

g) Whether the development or activity proposed is of a class of development or activity that is recognised as a threatening process.

Those Key Threatening Processes currently listed under Schedule 3 of the TSC Act 1995 with the potential to be relevant to this project include: clearing of native vegetation; bushrock removal; alteration to the natural flow regimes of rivers, streams, floodplains & wetlands; and removal of dead wood and dead trees.

h) Whether any threatened species, population or ecological community is at the limit of its known distribution.

The project area is not at the limit of the known distribution of *Thesium australe*.

7) Camden Woollybutt (*Eucalyptus macarthurii*)

Camden woollybutt (*Eucalyptus macarthurii*) is a tree to 40 metres with bark being persistent on the trunk and lower branches (Hill 2002). This species has a generally restricted distribution, occurring in grassy woodland habitats on relatively fertile soils on broad, cold flats (Hill 2002). Known records of this species occur from the Boyd Plateau to Paddys River (Hill 2002). In the southern highlands, this species often occurs as isolated individuals in, or on the edges of paddocks (NSW Scientific Committee 2005).

This species is not currently listed on the TSC Act 1995, however, a preliminary determination has been made by the NSW Scientific Committee to list the species as vulnerable. The species has therefore been assessed as a listed threatened species.

a) In the case of a threatened species, whether the life cycle of the species is likely to be disrupted such that a viable population of the species is likely to be placed at risk of extinction.

This species was identified in the project area as a small, isolated remnant approximately 0.18 hectares in size. While not confirmed, there is the potential that this stand was planted. The project will require the removal of this stand for the establishment of the Western Overburden Emplacement Area. To ameliorate this loss, it is proposed that a 0.4 hectare area of Camden woollybutt (*Eucalyptus macarthurii*) be replanted within the project area where possible using seed gathered from the specimens currently present in the project area. Due to the small size and high degree of isolation of this remnant, it is unlikely that the project would place a viable population of the species at risk of extinction.

b) In the case of an endangered population, whether the lifecycle of the species that constitutes the endangered population is likely to be disrupted such that the viability of the population is likely to be significantly compromised.

No endangered populations of this species are recorded in the project area.

c) In relation to the regional distribution of the habitat of a threatened species, population or ecological community, whether a significant area of known habitat is to be modified or removed.

The project will require the removal of the recorded stand of this species from the project area. Due to the small size and extreme isolation of the stand to be removed, it is unlikely that a

significant area of known habitat will be removed. In order to ameliorate this loss, it is proposed that 0.4 hectares of Camden woollybutt (*Eucalyptus macarthurii*) be replanted within the project area using seed gathered from the existing specimens, where possible.

d) Whether an area of known habitat is likely to become isolated from currently interconnecting or proximate areas for a threatened species population or ecological community.

The project will require the removal of the recorded stand of this species from the project area. This stand occurs within a highly fragment landscape and is currently completely isolated from other areas of interconnecting vegetation. In order to ameliorate the loss of this stand, it is proposed that 0.4 hectares of Camden woollybutt (*Eucalyptus macarthurii*) will be replanted within the project area. This replanting could occur adjacent to existing habitat to allow for greater connectivity.

e) Whether critical habitat will be affected.

No areas of critical habitat are present within the project area. There will be no loss of critical habitat for any threatened species, populations or ecological communities as a result of the project.

f) Whether a threatened species, population or ecological community, or their habitats are adequately represented in conservation reserves (or other similar protected areas) in the region.

The only known record of this species within conservation reserves comes from Kanangra-Boyd National Park (NSW Scientific Committee 2005). It is not known if Camden woollybutt (*Eucalyptus macarthurii*) is adequately represented in conservation reserves in the region.

g) Whether the development or activity proposed is of a class of development or activity that is recognised as a threatening process.

Those Key Threatening Processes currently listed under Schedule 3 of the TSC Act 1995 with the potential to be relevant to this project include: clearing of native vegetation; bushrock removal; alteration to the natural flow regimes of rivers, streams, floodplains & wetlands; and removal of dead wood and dead trees.

h) Whether any threatened species, population or ecological community is at the limit of its known distribution.

Known records of this species occur from the Boyd Plateau to Paddys River (Hill 2002). The project area is likely to be close to the limit of the known distribution of this species.

8) Giant Burrowing Frog - *Heleioporus australiacus*

The giant burrowing frog is a large frog up to 90 mm long that is restricted to Hawkesbury sandstone (Robinson 1993) occurring from south east NSW to Victoria (NPWS 2001a). In the southern population, records from Narooma, Bega, Bombala and eastern Victoria appear to be

associated with Devonian igneous and sedimentary formations and Ordovician metamorphics and are generally from more heavily timbered areas. This species prefers woodland and heath in sandstone ridgetop habitat and broader upland valleys. In particular it is found in small headwater creek lines and slow flowing or intermittent creek lines (NPWS 2001a). This species has a generalist diet, primarily feeding on invertebrates (NPWS 2001a).

a) In the case of a threatened species, whether the life cycle of the species is likely to be disrupted such that a viable population of the species is likely to be placed at risk of extinction.

The giant burrowing frog was not recorded during surveys of the project area. The creekline habitat within the project area is, however, potentially suitable for this species. The project will result in the disturbance of some areas of potential habitat for this species, however, the majority of areas will be retained. As the majority of potential habitat for this species will be retained, it is considered that the project will not disrupt the lifecycle of this species such that a viable population is likely to be placed at risk of extinction.

b) In the case of an endangered population, whether the lifecycle of the species that constitutes the endangered population is likely to be disrupted such that the viability of the population is likely to be significantly compromised.

No populations listed as endangered under the TSC Act 1995 are present within the project area.

c) In relation to the regional distribution of the habitat of a threatened species, population or ecological community, whether a significant area of known habitat is to be modified or removed.

The project area is not known habitat of the giant burrowing frog. This species was not recorded during surveys of the project area. While there is potential foraging and breeding habitat for this species in the project area and some of this potential habitat will be impacted, the majority of potential habitat will be retained. A significant area of potential habitat for this species will not be modified by the project.

d) Whether an area of known habitat is likely to become isolated from currently interconnecting or proximate areas for a threatened species population or ecological community.

The project area is not known habitat for the giant burrowing frog. There is, however, potential habitat for this species in the project area. The project will result in the disturbance of some areas of potential habitat for the species but will not result in a significant increase in isolation of available habitat. Given the project area is not known habitat for the species, the project will not result in an area of known habitat becoming isolated from currently interconnecting or proximate areas of habitat for the species.

e) Whether critical habitat will be affected.

No areas of critical habitat are present within the project area. There will be no loss of critical habitat for any threatened species, populations or ecological communities as a result of the project.

f) Whether a threatened species, population or ecological community, or their habitats are adequately represented in conservation reserves (or other similar protected areas) in the region.

This species has been recorded from one conservation reserve within a 50 kilometre radius of the project area, this being Morton National Park. It is considered that neither this species, nor its habitat is likely to be adequately represented in conservation reserves in the region.

g) Whether the development or activity proposed is of a class of development or activity that is recognised as a threatening process.

Those Key Threatening Processes currently listed under Schedule 3 of the TSC Act 1995 with the potential to be relevant to this project include: clearing of native vegetation; bushrock removal; alteration to the natural flow regimes of rivers, streams, floodplains & wetlands; and removal of dead wood and dead trees.

h) Whether any threatened species, population or ecological community is at the limit of its known distribution.

The giant burrowing frog is a large frog up to 90mm that is restricted to Hawkesbury sandstone occurring from south east New South Wales to Victoria (NPWS 2001a). In the southern population, records from Narooma, Bega, Bombala and eastern Victoria appear to be associated with Devonian igneous and sedimentary formations and Ordovician metamorphics. The project area is not at the limit of the known distribution of this species.

9) Rosenberg's Goanna – *Varanus rosenbergi*

This large goanna grows to around one metre, occurring in the far south of Western and South Australia. Isolated populations occur in Victoria and coastal NSW (Cogger 2000). This species is commonly found in coastal heath, humid woodland and wet and dry sclerophyll forest (Cogger 2000). It shelters in burrows, hollows and rock crevices.

a) In the case of a threatened species, whether the life cycle of the species is likely to be disrupted such that a viable population of the species is likely to be placed at risk of extinction.

Rosenberg's goanna was not recorded during surveys of the project area. The habitat within the project area is, however, potentially suitable for this species. Small numbers of forageable termite mounds were present within the project area. The project will result in the removal of some potential habitat for this species however, the majority of potential habitat in the project area will be retained, with large areas to be protected in a Habitat Management Area. The project is therefore considered unlikely to disrupt the lifecycle of this species such that a viable population is likely to be placed at risk of extinction.

b) In the case of an endangered population, whether the lifecycle of the species that constitutes the endangered population is likely to be disrupted such that the viability of the population is likely to be significantly compromised.

No endangered populations are present within the project area.

c) In relation to the regional distribution of the habitat of a threatened species, population or ecological community, whether a significant area of known habitat is to be modified or removed.

The project area is not known habitat for Rosenberg's goanna. This species was not recorded during surveys of the project area. While there is potential foraging and nesting habitat for this species in the project area and some of this potential habitat will be impacted, the majority of potential habitat areas will be retained. A significant area of potential habitat for this species will not, therefore be modified by the project.

d) Whether an area of known habitat is likely to become isolated from currently interconnecting or proximate areas for a threatened species population or ecological community.

The project area is not known habitat for Rosenberg's goanna. There is, however potential habitat for this species in the project area. The project will result in the removal of areas of potential habitat for the species and reduce the size of some bushland patches in the project area. It will not, however, result in a significant increase in isolation of available potential habitat. Given the project area is not known habitat for the species and the majority of potential habitat will be retained, the project will not result in an area of known or potential habitat becoming isolated from currently interconnecting or proximate areas of habitat for the species.

e) Whether critical habitat will be affected.

No areas of critical habitat are present within the project area. There will be no loss of critical habitat for any threatened species, populations or ecological communities as a result of the project.

f) Whether a threatened species, population or ecological community, or their habitats are adequately represented in conservation reserves (or other similar protected areas) in the region.

This species has been recorded from one conservation reserve within a 50 kilometre radius of the project area, this being Morton National Park. It is considered that neither this species, nor its habitat is adequately represented in conservation reserves in the region.

g) Whether the development or activity proposed is of a class of development or activity that is recognised as a threatening process.

Those Key Threatening Processes currently listed under Schedule 3 of the TSC Act 1995 with the potential to be relevant to this project include: clearing of native vegetation; bushrock removal; alteration to the natural flow regimes of rivers, streams, floodplains & wetlands; and removal of dead wood and dead trees.

h) Whether any threatened species, population or ecological community is at the limit of its known distribution.

This species occurs in the far south of Western and South Australia. Isolated populations occur in Victoria and coastal NSW (Cogger 1992). The project area is not at the limit of the known distribution of this species.

10) Striped Legless Lizard - *Delma impar*

The striped legless lizard occurs in extreme south-eastern South Australia, Victoria and south-eastern NSW west of the Great Dividing Range (Cogger 2000). A few individuals have been found near Goulburn (Zoos Victoria 2004), and there may be an isolated population in the Hunter Valley (Swan 1990). The preferred habitat of this species is lowland native grasslands dominated by tussock forming grass species (Nunan 2004). The species is nocturnal (Swan 1990), feeding on a diet of insects including crickets, moth larvae and spiders (Nunan 2004). Breeding occurs in spring to early summer.

a) In the case of a threatened species, whether the life cycle of the species is likely to be disrupted such that a viable population of the species is likely to be placed at risk of extinction.

The striped legless lizard was not recorded during surveys of the project. The habitat within the project area is potentially suitable for this species. The project will result in the removal of some areas of potential habitat for this species. The majority of potential habitat will, however, be retained and it is therefore considered unlikely that the project will disrupt the lifecycle of this species such that a viable population is likely to be placed at risk of extinction.

b) In the case of an endangered population, whether the lifecycle of the species that constitutes the endangered population is likely to be disrupted such that the viability of the population is likely to be significantly compromised.

No populations listed as endangered under the TSC Act 1995 are present within the project area.

c) In relation to the regional distribution of the habitat of a threatened species, population or ecological community, whether a significant area of known habitat is to be modified or removed.

The project area is not known habitat for the striped legless lizard. This species was not recorded during surveys of the project area. While there is potential habitat for this species in the project area and some of this habitat will be impacted, the majority of potential habitat will be retained, including the formation of a Habitat Management Area. A significant area of potential habitat for this species will not, therefore, be modified by the project.

d) Whether an area of known habitat is likely to become isolated from currently interconnecting or proximate areas for a threatened species population or ecological community.

The project area is not known habitat for striped legless lizard. There is, however potential habitat for this species in the project area. The project will result in the removal of some areas of potential habitat for the species but will not result in a significant increase in isolation of available habitat. Given the project area is not known habitat for the species and large areas of potential habitat will be retained, the project will not result in an area of potential habitat becoming isolated from currently interconnecting or proximate areas of habitat for the species.

e) Whether critical habitat will be affected.

No areas of critical habitat are present within the project area. There will be no loss of critical habitat for any threatened species, populations or ecological communities as a result of the project.

f) Whether a threatened species, population or ecological community, or their habitats are adequately represented in conservation reserves (or other similar protected areas) in the region.

This species has not been recorded from conservation reserves within a 50 kilometre radius of the project area, these being Bungonia State Conservation Area, Morton National Park, Throsby Park Historic Site, Cecil Hoskins Nature Reserve and Budderoo National Park. It is considered that neither this species, nor its habitat is adequately represented in conservation reserves in the region.

g) Whether the development or activity proposed is of a class of development or activity that is recognised as a threatening process.

Those Key Threatening Processes currently listed under Schedule 3 of the TSC Act 1995 with the potential to be relevant to this project include: clearing of native vegetation; bushrock removal; alteration to the natural flow regimes of rivers, streams, floodplains & wetlands; and removal of dead wood and dead trees.

h) Whether any threatened species, population or ecological community is at the limit of its known distribution.

The striped legless lizard occurs in extreme southeastern South Australia, Victoria and southeastern NSW, west of the Great Dividing Range (Cogger 2000). A few individuals have been found near Goulburn (Zoos Victoria 2004), and there may be an isolated population in the Hunter Valley (Swan 1990). The project area is not at the limit of the known distribution for this species.

11) Blue-billed Duck - *Oxyura australis*

The blue-billed duck has a distribution ranging across south western and south eastern Australia, particularly in the Murray-Darling Basin and southern Victoria (Garnett & Crowley 2000). Habitat includes temperate wetlands (fresh to saline), as well as sewerage ponds, rivers, salt lakes and salt pans (Garnett & Crowley 2000). They favour deep, permanent well vegetated freshwater swamps, particularly with cumbungi beds (NSW NPWS 1999d). Young, non-breeding ducks form large nomadic flocks, particularly in autumn and winter (NSW NPWS 1999d). Nesting occurs in dense vegetation (NSW NPWS 1999d).

a) In the case of a threatened species, whether the life cycle of the species is likely to be disrupted such that a viable population of the species is likely to be placed at risk of extinction.

The blue-billed duck was not recorded during surveys of the project area. The aquatic habitat in the project area does not form ideal habitat for this species, however, it may provide a potential stop-over point during wet years. The project will result in the removal of some potential habitat

for this species, however, the project water management system will create larger additional areas of potential habitat in the form of water management dams. The project is therefore considered unlikely to disrupt the lifecycle of this species such that a viable population is likely to be placed at risk of extinction.

b) In the case of an endangered population, whether the lifecycle of the species that constitutes the endangered population is likely to be disrupted such that the viability of the population is likely to be significantly compromised.

No populations listed as endangered under the TSC Act 1995 are present within the project area.

c) In relation to the regional distribution of the habitat of a threatened species, population or ecological community, whether a significant area of known habitat is to be modified or removed.

The project area is not known habitat for the blue-billed duck. This species was not recorded during surveys of the project area. While there is potential habitat for this species in the project area and some of this potential habitat will be impacted, the project will result in the creation of increased areas of potential habitat. A significant area of potential habitat for this species will not be modified by the project.

d) Whether an area of known habitat is likely to become isolated from currently interconnecting or proximate areas for a threatened species population or ecological community.

The project area does not form known habitat for the blue-billed duck. There is, however, potential habitat for this species in the project area. The project will result in the removal of some areas of potential habitat for the species, however additional, larger potential habitat areas will be created. The project is unlikely therefore to result in the isolation of available habitat for the species.

e) Whether critical habitat will be affected.

No areas of critical habitat are present within the project area. There will be no loss of critical habitat for any threatened species, populations or ecological communities as a result of the project.

f) Whether a threatened species, population or ecological community, or their habitats are adequately represented in conservation reserves (or other similar protected areas) in the region.

This species has been recorded from one conservation reserve within a 50 kilometre radius of the project area, that being Cecil Hoskins Nature Reserve (one record). It is considered that neither this species, nor its habitat is adequately represented in conservation reserves in the region.

g) Whether the development or activity proposed is of a class of development or activity that is recognised as a threatening process.

Those Key Threatening Processes currently listed under Schedule 3 of the TSC Act 1995 with the potential to be relevant to this project include: clearing of native vegetation; bushrock

removal; alteration to the natural flow regimes of rivers, streams, floodplains & wetlands; and removal of dead wood and dead trees.

h) Whether any threatened species, population or ecological community is at the limit of its known distribution.

The blue-billed duck has a distribution ranging across south western and south eastern Australia, particularly in the Murray-Darling Basin and southern Victoria (Garnett & Crowley 2000). The project area is not at the limit of the species known distribution.

12) Swift Parrott- *Lathamus discolor*

The swift parrot breeds in Tasmania, migrating to the mainland in May to August, where it forages on flowering eucalypts mainly in Victoria and NSW (Swift Parrot Recovery Team 2001). In NSW, it has been recorded from the western slopes region along the inland slopes of the Great Dividing Range, as well as forests along the coastal plains from southern to northern NSW (Swift Parrot Recovery Team 2001). This species often visit box-ironbark forests, feeding on nectar and lerps (Garnett & Crowley 2000). In NSW, typical feed species include mugga ironbark, grey box, swamp mahogany, spotted gum, red bloodwood, narrow-leaved red ironbark, forest red gum and yellow box (Swift Parrot Recovery Team 2001). Of such species, larger trees bearing more flowers are selected. The species breeds in Tasmania, migrating to the mainland in May to August to forage.

a) In the case of a threatened species, whether the life cycle of the species is likely to be disrupted such that a viable population of the species is likely to be placed at risk of extinction.

The swift parrot was not recorded during surveys of the project area. The vegetation of the project area does provide potential habitat for this species, particularly in the form of flowering eucalypt species. The project will result in the removal of some areas of potential habitat for this species, however, the majority of potential habitat will be retained, including the formation of a Habitat Management Area. The project is therefore considered unlikely to disrupt the lifecycle of this species such that a viable population is likely to be placed at risk of extinction.

b) In the case of an endangered population, whether the lifecycle of the species that constitutes the endangered population is likely to be disrupted such that the viability of the population is likely to be significantly compromised.

No populations listed as endangered under the TSC Act 1995 are present within the project area.

c) In relation to the regional distribution of the habitat of a threatened species, population or ecological community, whether a significant area of known habitat is to be modified or removed.

The project area is not known habitat for the swift parrot. This species was not recorded during surveys of the project area. While there is potential foraging habitat for this species in the project area and some areas of potential habitat will be impacted, the majority of potential habitat will be retained. A significant area of known habitat for this species will not, therefore, be modified by the project.

d) Whether an area of known habitat is likely to become isolated from currently interconnecting or proximate areas for a threatened species population or ecological community.

The project area does not form known habitat for the swift parrot. There is, however, potential habitat for this species in the project area. The project will result in the removal of some areas of potential habitat for the species but the majority of potential habitat areas will be retained and the project will not therefore result in a significant increase in isolation of available potential habitat.

e) Whether critical habitat will be affected.

No areas of critical habitat are present within the project area. There will be no loss of critical habitat for any threatened species, populations or ecological communities as a result of the project.

f) Whether a threatened species, population or ecological community, or their habitats are adequately represented in conservation reserves (or other similar protected areas) in the region.

This species has not been recorded from conservation reserves within a 50 kilometre radius of the project area, these being Bungonia State Conservation Area, Morton National Park, Throsby Park Historic Site, Cecil Hoskins Nature Reserve and Budderoo National Park. It is considered that neither this species, nor its habitat is adequately represented in conservation reserves in the region.

g) Whether the development or activity proposed is of a class of development or activity that is recognised as a threatening process.

Those Key Threatening Processes currently listed under Schedule 3 of the TSC Act 1995 with the potential to be relevant to this project include: clearing of native vegetation; bushrock removal; alteration to the natural flow regimes of rivers, streams, floodplains & wetlands; and removal of dead wood and dead trees.

h) Whether any threatened species, population or ecological community is at the limit of its known distribution.

The swift parrot breeds in Tasmania, migrating to the mainland in May to August, where it forages on flowering eucalypts mainly in Victoria and NSW (Swift Parrot Recovery Team 2001). In NSW, it has been recorded from the western slopes region along the inland slopes of the Great Dividing Range, as well as forests along the coastal plains from southern to northern NSW (Swift Parrot Recovery Team 2001). The project area is not at the limit of the known distribution of the species.

13) Barking Owl –*Ninox connivens*

The barking owl is distributed sparsely throughout temperate and semi-arid areas of mainland Australia, however it is most abundant in the tropical north (Kavanagh 2002a). Most records for this species occur west of the Great Dividing Range (Kavanagh 2004). The species habitat preferences include dry forests and woodlands (Kavanagh 2002a), often in association with

hydrological features such as rivers and swamps (Taylor et al. 2002). Taylor et al. (2002) reports that not enough data has been collected to accurately estimate home range sizes, however one has been radio-tracked over 226 hectares. Large hollows are required for breeding. Barking owls are strictly seasonal breeders, laying in late winter or spring (NSW NPWS 2003). Barking Owls have broad diets dominated by ground-dwelling mammals, birds and insects (Kavanagh 2002b).

a) In the case of a threatened species, whether the life cycle of the species is likely to be disrupted such that a viable population of the species is likely to be placed at risk of extinction.

The barking owl was not recorded during surveys of the project area. Potential foraging habitat for the barking owl occurs across the project area and potentially suitable hollows for roosting and breeding may occur along the creek-lines. The project will result in the removal of some potential habitat for this species, however, the majority of potential habitat will be retained, including the rehabilitation of the species preferred habitat of riparian corridors and the formation of a Habitat Management Area. The project is therefore unlikely to disrupt the lifecycle of this species such that a viable population is likely to be placed at risk of extinction.

b) In the case of an endangered population, whether the lifecycle of the species that constitutes the endangered population is likely to be disrupted such that the viability of the population is likely to be significantly compromised.

No populations listed as endangered under the TSC Act 1995 are present within the project area.

c) In relation to the regional distribution of the habitat of a threatened species, population or ecological community, whether a significant area of known habitat is to be modified or removed.

The project area is not known habitat for the barking owl. This species was not recorded during surveys of the project area. While there is potential foraging and nesting habitat for this species in the project area and some areas of potential habitat will be removed, the majority of potential habitat will be retained and enhanced. A significant area of potential habitat for this species will not, therefore, be modified by the project.

d) Whether an area of known habitat is likely to become isolated from currently interconnecting or proximate areas for a threatened species population or ecological community.

The project area is not known habitat for the barking owl. There is, however potential habitat for this species in the project area. The project area will result in the removal of some areas of potential habitat for the species but will not result in a significant increase in isolation of available habitat. Given the project area is not known habitat for the species and the majority of potential habitat will be retained, the project will not result in an area of potential habitat becoming isolated from currently interconnecting or proximate areas of habitat for the species.

e) Whether critical habitat will be affected.

No areas of critical habitat are present within the project area. There will be no loss of critical habitat for any threatened species, populations or ecological communities as a result of the project.

f) Whether a threatened species, population or ecological community, or their habitats are adequately represented in conservation reserves (or other similar protected areas) in the region.

This species has not been recorded from conservation reserves within a 50 kilometre radius of the project area, these being Bungonia State Conservation Area, Morton National Park, Throsby Park Historic Site, Cecil Hoskins Nature Reserve and Budderoo National Park. It is considered that neither this species, nor its habitat is adequately represented in conservation reserves in the region.

g) Whether the development or activity proposed is of a class of development or activity that is recognised as a threatening process.

Those Key Threatening Processes currently listed under Schedule 3 of the TSC Act 1995 with the potential to be relevant to this project include: clearing of native vegetation; bushrock removal; alteration to the natural flow regimes of rivers, streams, floodplains & wetlands; and removal of dead wood and dead trees.

h) Whether any threatened species, population or ecological community is at the limit of its known distribution.

The barking owl is distributed sparsely throughout temperate and semi-arid areas of mainland Australia, however is most abundant in the tropical north (Kavanagh 2002). The project area is not at the limit of the known distribution for this species.

14) Masked Owl – *Tyto novaehollandiae*

The masked owl occurs sparsely throughout the continent and nearby islands, including Tasmania and New Guinea (Kavanagh 2002a). This species is generally recorded from open forest habitat with sparse mid-storey but patches of dense, low ground cover. It is also recorded from ecotones between wet and dry eucalypt forest, along minor drainage lines and near boundaries between forest and cleared land (Kavanagh 2004). Home range estimates vary between 800 and 1200 hectares (Kavanagh 2002a). Masked owls nest (and roost) in large hollows of old trees. The species also roosts among dense foliage in variety of sub-canopy trees (Kavanagh 2004). Masked Owls commonly prey on small terrestrial and scansorial mammals, occasionally supplementing with diurnal birds (Kavanagh 2002b).

a) In the case of a threatened species, whether the life cycle of the species is likely to be disrupted such that a viable population of the species is likely to be placed at risk of extinction.

The masked owl was not recorded during surveys of the project area. Potential foraging habitat for the masked owl occurs across the project area and potentially suitable hollows for roosting and breeding may occur along the creek-lines. The project will result in the removal of some

potential habitat for this species, however, the majority of potential habitat areas will be retained, including the establishment of a Habitat Management Area and rehabilitation of riparian corridors. The project is therefore considered unlikely to disrupt the lifecycle of this species such that a viable population is likely to be placed at risk of extinction.

b) In the case of an endangered population, whether the lifecycle of the species that constitutes the endangered population is likely to be disrupted such that the viability of the population is likely to be significantly compromised.

No populations listed as endangered under the TSC Act 1995 are present within the project area.

c) In relation to the regional distribution of the habitat of a threatened species, population or ecological community, whether a significant area of known habitat is to be modified or removed.

The project area is not known habitat for the masked owl. This species was not recorded during surveys of the project area. While there is potential foraging and nesting habitat for this species in the project area and some of this potential habitat will be removed, the majority of potential habitat will be retained. A significant area of potential habitat for this species will, therefore, not be modified by the project.

d) Whether an area of known habitat is likely to become isolated from currently interconnecting or proximate areas for a threatened species population or ecological community.

The project area is not known habitat for the masked owl. There is, however potential habitat for this species in the project area. The project will result in the removal of some areas of potential habitat for the species but will not result in a significant increase in isolation of available potential habitat. Given the project area is not known habitat for the species and the majority of potential habitat will be retained, the project will not result in an area of known habitat becoming isolated from currently interconnecting or proximate areas of habitat for the species.

e) Whether critical habitat will be affected.

No areas of critical habitat are present within the project area. There will be no loss of critical habitat for any threatened species, populations or ecological communities as a result of the project.

f) Whether a threatened species, population or ecological community, or their habitats are adequately represented in conservation reserves (or other similar protected areas) in the region.

This species has been recorded from two conservation reserves within a 50 kilometre radius of the project, these being Bungonia State Conservation Area (one record) and Morton National Park (three records). It is considered that neither this species, nor its habitat is adequately represented in conservation reserves in the region.

g) Whether the development or activity proposed is of a class of development or activity that is recognised as a threatening process.

Those Key Threatening Processes currently listed under Schedule 3 of the TSC Act 1995 with the potential to be relevant to this project include: clearing of native vegetation; bushrock removal; alteration to the natural flow regimes of rivers, streams, floodplains & wetlands; and removal of dead wood and dead trees.

h) Whether any threatened species, population or ecological community is at the limit of its known distribution.

The Masked Owl occurs sparsely throughout the continent and nearby islands, including Tasmania and New Guinea (Kavanagh 2002a). The project area is not at the limit of the known distribution for this species.

15) Brown Treecreeper - *Climacteris picumnus victoriae*

This species occurs across central NSW, west of the Great Dividing Range and sparsely scattered to the east of the Divide in drier areas such as the Cumberland Plain of Western Sydney, and in parts of the Hunter, Clarence, Richmond and Snowy River valleys (NSW Scientific Committee 2001). Typical habitat for this species includes drier forests, woodlands, scrubs, with fallen branches; river red gums on watercourses and around lake-shores; paddocks with standing dead timber; and margins of denser wooded areas (Pizzey & Knight 1997). It prefers areas without dense understorey (NSW Scientific Committee 2001) and occupies permanent territories, building a nest of grass usually in tree hollows 3-10 metres or higher, or in stumps or fence posts. The species is highly sensitive to habitat fragmentation, with disrupted dispersal due to habitat isolation being the primary threat (Walters et al. 1999).

a) In the case of a threatened species, whether the life cycle of the species is likely to be disrupted such that a viable population of the species is likely to be placed at risk of extinction.

The brown treecreeper was not recorded during surveys of the project area. The vegetation on the project area provides potential habitat for this species, particularly in areas lacking understorey layers. The abundance of small to medium sized hollows provides potential nesting habitat for this species. The project will result in the removal of some potential habitat for this species, however the majority of potential habitat will be retained including the formation of a Habitat Management Area and rehabilitation of riparian corridors. The loss of tree hollows will be offset by hollow re-erection and use of nest boxes. The project is therefore considered unlikely to disrupt the lifecycle of this species such that a viable population is likely to be placed at risk of extinction.

b) In the case of an endangered population, whether the lifecycle of the species that constitutes the endangered population is likely to be disrupted such that the viability of the population is likely to be significantly compromised.

No populations listed as endangered under the TSC Act 1995 are present within the project area.

c) In relation to the regional distribution of the habitat of a threatened species, population or ecological community, whether a significant area of known habitat is to be modified or removed.

The project area is not known habitat for the brown treecreeper. This species was not recorded during surveys of the project area. While there is potential foraging and nesting habitat for this species in the project area and some of this potential habitat will be impacted, the majority of potential habitat will be retained. A significant area of potential habitat for this species will not be removed by the project.

d) Whether an area of known habitat is likely to become isolated from currently interconnecting or proximate areas for a threatened species population or ecological community.

The project area does not form known habitat for the brown treecreeper. There is, however, potential habitat for this species in the project area. The project will result in the removal of some areas of potential habitat for the species and reduce the size of some bushland patches in the project area but will not result in a significant increase in isolation of available habitat. Given the project area is not known habitat for the species, the project will not result in an area of known habitat becoming isolated from currently interconnecting or proximate areas of habitat for the species.

e) Whether critical habitat will be affected.

No areas of critical habitat are present within the project area. There will be no loss of critical habitat for any threatened species, populations or ecological communities as a result of the project.

f) Whether a threatened species, population or ecological community, or their habitats are adequately represented in conservation reserves (or other similar protected areas) in the region.

This species has not been recorded from conservation reserves within a 50 kilometre radius of the project area, these being Bungonia State Conservation Area, Morton National Park, Throsby Park Historic Site, Cecil Hoskins Nature Reserve and Budderoo National Park. It is considered that neither this species, nor its habitat is adequately represented in conservation reserves in the region.

g) Whether the development or activity proposed is of a class of development or activity that is recognised as a threatening process.

Those Key Threatening Processes currently listed under Schedule 3 of the TSC Act 1995 with the potential to be relevant to this project include: clearing of native vegetation; bushrock removal; alteration to the natural flow regimes of rivers, streams, floodplains & wetlands; and removal of dead wood and dead trees.

h) Whether any threatened species, population or ecological community is at the limit of its known distribution.

The brown treecreeper occurs across central NSW, west of the Great Dividing Range and sparsely scattered to the east of the divide in drier areas such as the Cumberland Plain of

Western Sydney, and in parts of the Hunter, Clarence, Richmond and Snowy River valleys (NSW Scientific Committee 2001). The project area is not at the limit of this known distribution.

16) Regent Honeyeater – *Xanthomyza phrygia*

The regent honeyeater has a patchy distribution across the eastern states of Australia (NSW NPWS 1999n). This semi-nomadic species generally occurs in temperate eucalypt woodlands and open forests of south eastern Australia. It is commonly recorded from box-ironbark eucalypt associations, wet lowland coastal forests dominated by swamp mahogany, spotted gum and riverine casuarina woodlands (NSW NPWS 1999n). An apparent preference exists for the wettest, most fertile sites within these associations, such as creek flats, river valleys and foothills (Garnet & Crowley 2000). Breeding occurs between July and November. Known breeding sites are rare, with the most important sites being in the Warrumbungles National Park, Pilliga Nature Reserve, Barraba district, Gosford area, Hunter Valley and Capertee Valley (NSW NPWS 1999n).

a) In the case of a threatened species, whether the life cycle of the species is likely to be disrupted such that a viable population of the species is likely to be placed at risk of extinction.

The regent honeyeater was not recorded during surveys of the project area. Some of the vegetation in the project area provides marginal potential habitat for this species with some box species but no ironbark species occurring. While the project area does provide potential nesting habitat for this species, the area has not been identified as a breeding area (NSW NPWS 1999n). The project will result in the removal of potential habitat for this species, however, the majority of potential habitat areas will be retained, with the preferred riparian habitat areas proposed to be enhanced as part of the project. The project is therefore considered unlikely to disrupt the lifecycle of this species such that a viable population is likely to be placed at risk of extinction.

b) In the case of an endangered population, whether the lifecycle of the species that constitutes the endangered population is likely to be disrupted such that the viability of the population is likely to be significantly compromised.

No populations listed as endangered under the TSC Act 1995 are present within the project area.

c) In relation to the regional distribution of the habitat of a threatened species, population or ecological community, whether a significant area of known habitat is to be modified or removed.

The project area is not known habitat for the regent honeyeater. This species was not recorded during surveys of the project area. While there is potential foraging and nesting habitat for this species in the project area and some of this potential habitat will be removed, the majority of potential habitat areas will be retained and enhanced. A significant area of potential habitat for this species will not be modified by the project.

d) Whether an area of known habitat is likely to become isolated from currently interconnecting or proximate areas for a threatened species population or ecological community.

The project area does not form known habitat for the regent honeyeater. There is, however, potential habitat for this species in the project area. The project will result in the removal of areas of potential habitat for the species and reduce the size of some bushland patches on the study site but will not result in a significant increase in isolation of available known habitat. Given the site is not known habitat for the species and the majority of potential habitat will be retained, the project will not result in an area of known habitat becoming isolated from currently interconnecting or proximate areas of habitat for the species.

e) Whether critical habitat will be affected.

No areas of critical habitat are present within the project area. There will be no loss of critical habitat for any threatened species, populations or ecological communities as a result of the project.

f) Whether a threatened species, population or ecological community, or their habitats are adequately represented in conservation reserves (or other similar protected areas) in the region.

This species has been recorded from two conservation reserves within a 50 kilometre radius of the project area, these being Bungonia State Conservation Area (one record) and Morton National Park (two records). It is considered that neither this species, nor its habitat is adequately represented in conservation reserves in the region.

g) Whether the development or activity proposed is of a class of development or activity that is recognised as a threatening process.

Those Key Threatening Processes currently listed under Schedule 3 of the TSC Act 1995 with the potential to be relevant to this project include: clearing of native vegetation; bushrock removal; alteration to the natural flow regimes of rivers, streams, floodplains & wetlands; and removal of dead wood and dead trees.

h) Whether any threatened species, population or ecological community is at the limit of its known distribution.

The regent honeyeater has a patchy distribution throughout the eastern states of Australia. The project area is not at the limit of this known distribution.

17) Hooded Robin – *Melanodryas cucullata cucullata*

This form of the hooded robin is distributed throughout south-eastern Australia, from central Queensland to the Spencer Gulf, South Australia. This form occurs throughout NSW except for the north-west, where it intergrades with the northern form *M. cucullata picata* (NSW Scientific Committee 2001f). The species occupies a range of eucalypt woodlands, acacia shrublands and open forests. In temperate woodlands, it favours open areas adjoining large woodland blocks, with areas of dead timber and sparse shrub cover (NSW Scientific Committee 2001f). In semi-arid western NSW, the species favours open woodlands of belah, rosewood, mulga and cypress. Hooded robins live in small family groups, and build cup-shaped nests. Home ranges are relatively large, and averaged 18 ha for birds from the New England Tableland (NSW Scientific Committee 2001f). The species appears unable to survive in remnants smaller than 100-200 hectares (NSW Scientific Committee 2001f).

a) In the case of a threatened species, whether the life cycle of the species is likely to be disrupted such that a viable population of the species is likely to be placed at risk of extinction.

The hooded robin was not recorded during surveys of the project area. The vegetation in the project area does provide potential habitat for this species, particularly in the form of vegetation with a sparse shrub cover and fallen timber adjacent to large woodland blocks. The project area also provides potential nesting habitat for this species. The project will result in the removal of some potential habitat for this species, however, the majority of potential habitat areas will be retained. The formation of the Habitat Management Area and the establishment of a vegetated corridor to connect this habitat to adjoining areas will further reduce any potential impact. It is therefore considered that the project will not disrupt the lifecycle of this species such that a viable population is likely to be placed at risk of extinction.

b) In the case of an endangered population, whether the lifecycle of the species that constitutes the endangered population is likely to be disrupted such that the viability of the population is likely to be significantly compromised.

No populations listed as endangered under the TSC Act 1995 are present within the project area.

c) In relation to the regional distribution of the habitat of a threatened species, population or ecological community, whether a significant area of known habitat is to be modified or removed.

The project area is not known habitat for the hooded robin. This species was not recorded during surveys of the project area. While there is potential foraging and nesting habitat for this species in the project area and some of this potential habitat will be removed, the majority of potential habitat will be retained. A significant area of potential habitat for this species will not, therefore, be modified by the project.

d) Whether an area of known habitat is likely to become isolated from currently interconnecting or proximate areas for a threatened species population or ecological community.

The project area does not form known habitat for the hooded robin. There is, however potential habitat for this species in the project area. The project will result in the removal of areas of potential habitat for the species and reduce the size of some bushland patches in the project area but will not result in a significant increase in isolation of available habitat due to the formation of the Habitat Management Area and strengthening of vegetation corridors. Given the project area is not known habitat for the species and the majority of potential habitat will be retained, the project will not result in an area of known habitat becoming isolated from currently interconnecting or proximate areas of habitat for the species.

e) Whether critical habitat will be affected.

No areas of critical habitat are present within the project area. There will be no loss of critical habitat for any threatened species, populations or ecological communities as a result of the project.

f) Whether a threatened species, population or ecological community, or their habitats are adequately represented in conservation reserves (or other similar protected areas) in the region.

This species has not been recorded from conservation reserves within a 50 kilometre radius of the project area. It is considered that neither this species, nor its habitat is adequately represented in conservation reserves in the region.

g) Whether the development or activity proposed is of a class of development or activity that is recognised as a threatening process.

Those Key Threatening Processes currently listed under Schedule 3 of the TSC Act 1995 with the potential to be relevant to this project include: clearing of native vegetation; bushrock removal; alteration to the natural flow regimes of rivers, streams, floodplains & wetlands; and removal of dead wood and dead trees.

h) Whether any threatened species, population or ecological community is at the limit of its known distribution.

This form of the hooded robin is distributed throughout south-eastern Australia, from central Queensland to the Spencer Gulf, South Australia. This form occurs throughout NSW except for the north-west, where it intergrades with the northern form *M. cucullata picata* (NSW Scientific Committee 2001f). The project area is not near the limit of the known distribution of this species.

18) Speckled Warbler - *Pyrrholaemus saggitata*

The speckled warbler has a distribution from south-eastern Queensland, through central and eastern NSW to Victoria. In NSW, the species occupies eucalypt and cypress woodlands, generally on the western slopes of the Great Dividing Range. They inhabit woodlands with a grassy understorey, leaf litter and shrub cover, often on ridges or gullies (Garnett & Crowley 2000). The species has also been recorded in cypress woodlands of the northern Riverina and in drier coastal areas such as the Cumberland Plain, Western Sydney and the Hunter and Snowy River valleys (NSW Scientific Committee 2001e). The species is sedentary, living in pairs or trios and nests on the ground in grass tussocks, dense litter and fallen branches. Home ranges vary from 6-12 hectares (NSW Scientific Committee 2001). Barrett et al. (1994) found that the species decreased in abundance as woodland area decreased, and it appears to be extinct in districts where no fragments larger than 100 hectares remain.

a) In the case of a threatened species, whether the life cycle of the species is likely to be disrupted such that a viable population of the species is likely to be placed at risk of extinction.

The speckled warbler was recorded during surveys of the project area in 2003. This species was recorded in two areas in the large vegetated remnant in the north eastern position of the project area. The majority of this area will be unaffected by the project with much of this vegetation to be incorporated into the Habitat Management Area. The strengthening of vegetated linkages between the Habitat Management Area and other remnant vegetation areas will reduce the potential for fragmentation to impact on this species. With these measures in place, it is considered that the project will not disrupt the lifecycle of this species such that a viable population is likely to be placed at risk of extinction.

b) In the case of an endangered population, whether the lifecycle of the species that constitutes the endangered population is likely to be disrupted such the viability of the population is likely to be significantly compromised.

No populations listed as endangered under the TSC Act 1995 are present within the project area.

c) In relation to the regional distribution of the habitat of a threatened species, population or ecological community, whether a significant area of known habitat is to be modified or removed.

The project area is known habitat for the speckled warbler. As discussed above, although part of this known habitat will be removed, the majority will be retained and enhanced through the formation of a Habitat Management Area and improved connectivity to adjoining vegetated areas. It is therefore considered that the project will not result in the removal of a significant area of known habitat.

d) Whether an area of known habitat is likely to become isolated from currently interconnecting or proximate areas for a threatened species population or ecological community.

The project will result in the removal of an area of known habitat, however, the majority of known habitat will be retained. The strengthening of connectivity between the retained habitat areas and adjoining habitat areas through the formation of vegetated corridors will ensure that the project does not result in the isolation of known habitat from currently interconnecting or proximate areas.

e) Whether critical habitat will be affected.

No areas of critical habitat are present within the project area. There will be no loss of critical habitat for any threatened species, populations or ecological communities as a result of the project.

f) Whether a threatened species, population or ecological community, or their habitats are adequately represented in conservation reserves (or other similar protected areas) in the region.

This species has not been recorded in any conservation reserves within a 50 kilometre radius of project area. It is considered that neither this species, nor its habitat is adequately represented in conservation reserves in the region.

g) Whether the development or activity proposed is of a class of development or activity that is recognised as a threatening process.

Those Key Threatening Processes currently listed under Schedule 3 of the TSC Act 1995 with the potential to be relevant to this project include: clearing of native vegetation; bushrock removal; alteration to the natural flow regimes of rivers, streams, floodplains & wetlands; and removal of dead wood and dead trees.

h) Whether any threatened species, population or ecological community is at the limit of its known distribution.

The speckled warbler has a distribution from south-eastern Queensland, through central and eastern NSW to Victoria. The project area is not at the limit of the known distribution of this species.

19) Diamond Firetail - *Stagonopleura guttata*

The diamond firetail occurs through central and eastern NSW, north into southern and central Queensland and south through Victoria to South Australia. In NSW, it mainly occurs west of the Great Dividing Range, although populations are known from drier coastal areas such as the Cumberland Plain and the Hunter, Clarence, Richmond and Snowy River valleys (NSW Scientific Committee 2001b). Habitat includes a range of eucalypt-dominated communities with a grassy understorey, including woodland, forest and mallee (Garnett & Crowley 2000). It appears that populations are unable to persist in areas where there are no vegetated remnants larger than 200 hectares (NSW Scientific Committee 2001b).

a) In the case of a threatened species, whether the life cycle of the species is likely to be disrupted such that a viable population of the species is likely to be placed at risk of extinction.

The diamond firetail was not recorded during surveys of the project area. The project area does provide potential habitat for this species. The project will result in the removal of some potential habitat for this species, however, the majority of potential habitat will be retained, including the formation of a Habitat Management Area and strengthening of riparian corridors and connectivity between vegetated remnants. The project is therefore considered unlikely to disrupt the lifecycle o f this species such that a viable population is likely to be placed at risk of extinction.

b) In the case of an endangered population, whether the lifecycle of the species that constitutes the endangered population is likely to be disrupted such the viability of the population is likely to be significantly compromised.

No populations listed as endangered under the TSC Act 1995 are present within the project area.

c) In relation to the regional distribution of the habitat of a threatened species, population or ecological community, whether a significant area of known habitat is to be modified or removed.

The project area is not known habitat for the diamond firetail. This species was not recorded during surveys of the project area. While there is potential foraging and nesting habitat for this species in the project area and some of this potential will be removed, the majority of potential habitat will be retained. A significant area of known habitat for this species will not therefore be modified by the project.

d) Whether an area of known habitat is likely to become isolated from currently interconnecting or proximate areas for a threatened species population or ecological community.

The project area does not form known habitat for the diamond firetail. There is, however potential habitat for this species in the project area. The project will result in the removal of some areas of potential habitat for the species but the majority of potential habitat will be retained and the project will not therefore result in a significant increase in isolation of available habitat. The project will not result in an area of known habitat becoming isolated from currently interconnecting or proximate areas of habitat for the species.

e) Whether critical habitat will be affected.

No areas of critical habitat are present within the project area. There will be no loss of critical habitat for any threatened species, populations or ecological communities as a result of the project.

f) Whether a threatened species, population or ecological community, or their habitats are adequately represented in conservation reserves (or other similar protected areas) in the region.

This species has not been recorded from conservation reserves within a 50 kilometre radius of the project area. It is considered that neither this species, nor its habitat is adequately represented in conservation reserves in the region.

g) Whether the development or activity proposed is of a class of development or activity that is recognised as a threatening process.

Those Key Threatening Processes currently listed under Schedule 3 of the TSC Act 1995 with the potential to be relevant to this project include: clearing of native vegetation; bushrock removal; alteration to the natural flow regimes of rivers, streams, floodplains & wetlands; and removal of dead wood and dead trees.

h) Whether any threatened species, population or ecological community is at the limit of its known distribution.

The diamond firetail occurs through central and eastern NSW, north into southern and central Queensland and south through Victoria to South Australia. In NSW, it mainly occurs west of the Great Dividing Range, although populations are known from drier coastal areas such as the Cumberland Plain and the Hunter, Clarence, Richmond and Snowy River valleys (NSW Scientific Committee 2001b). The project area is not at the limit of the known distribution for this species.

20) Spotted-tailed Quoll – *Dasyurus maculatus*

In NSW, the spotted-tailed quoll occurs on both sides of the Great Dividing Range, with highest densities occurring in the north east of the State. It occurs from the coast to the snowline and inland to the Murray River (Edgar & Belcher 2002). A separate subspecies (*gracilis*) exists in northern Queensland (NSW NPWS 1999g). Habitat for this species is highly varied, ranging from sclerophyll forest, woodlands, coastal heathlands and rainforests. Records exist from open country, grazing lands and rocky outcrops (NSW NPWS 1999g). Suitable den sites including hollow logs, tree hollows, rocky outcrops or caves are necessary (NSW NPWS 1999g). Home range estimates for this highly mobile species vary between 800 hectares and 20 km^2. These home ranges are often defined by a number of 'latrines' (Edgar & Belcher 2002) which are often

in exposed areas such as rocky outcrops. Breeding occurs generally between April and July (Edgar & Belcher 2002). This species feeds on a variety of species, ranging in size from small wallabies to insects and carrion (Edgar & Belcher 2002).

a) In the case of a threatened species, whether the life cycle of the species is likely to be disrupted such that a viable population of the species is likely to be placed at risk of extinction.

The spotted tailed quoll was not recorded in the project area. It is considered unlikely that the species would occur in the project area given the past land use history including substantial clearing, the prevalence of competitors such as foxes and the generally low productivity of the area. It is possible, however, that the project area could form part of a larger habitat area occupied in the wider area. This is, however, considered unlikely due to the extent of clearing in the Marulan area and the potential movement barriers presented by structures such as the Hume Highway. It is therefore considered unlikely that the project will disrupt the lifecycle of this species such that a viable population will be placed at risk of extinction.

b) In the case of an endangered population, whether the lifecycle of the species that constitutes the endangered population is likely to be disrupted such that the viability of the population is likely to be significantly compromised.

No populations listed as endangered under the TSC Act 1995 are present within the project area.

c) In relation to the regional distribution of the habitat of a threatened species, population or ecological community, whether a significant area of known habitat is to be modified or removed.

The project area is not known habitat for the spotted-tailed quoll. This species was not recorded during surveys of the project area. While there is marginal potential habitat for this species in the project area, the majority of this habitat will be retained and potential movement corridors strengthened. A significant area of known habitat for this species will not therefore be modified or removed by the project.

d) Whether an area of known habitat is likely to become isolated from currently interconnecting or proximate areas for a threatened species population or ecological community.

The project area does not form known habitat for the spotted-tailed quoll. There is, however marginal potential habitat for this species in the project area. The project will result in the removal of some areas of potential habitat for the species but will not result in a significant increase in isolation of available known habitat. The project development will not result in an area of known habitat becoming isolated from currently interconnecting or proximate areas of habitat for the species.

e) Whether critical habitat will be affected.

No areas of critical habitat are present within the project area. There will be no loss of critical habitat for any threatened species, populations or ecological communities as a result of the project.

f) Whether a threatened species, population or ecological community, or their habitats are adequately represented in conservation reserves (or other similar protected areas) in the region.

This species has been recorded from two conservation reserves within a 50 kilometre radius of the site, these being Morton National Park (seven records) and Budderoo National Park (two records). It is considered that neither this species, nor its habitat is adequately represented in conservation reserves in the region.

g) Whether the development or activity proposed is of a class of development or activity that is recognised as a threatening process.

Those Key Threatening Processes currently listed under Schedule 3 of the TSC Act 1995 with the potential to be relevant to this project include: clearing of native vegetation; bushrock removal; alteration to the natural flow regimes of rivers, streams, floodplains & wetlands; and removal of dead wood and dead trees.

h) Whether any threatened species, population or ecological community is at the limit of its known distribution.

In NSW, the spotted-tailed quoll occurs on both sides of the Great Dividing Range, with highest densities occurring in the north east of the State. It occurs from the coast to the snowline and inland to the Murray River (Edgar & Belcher 2002). The project area is not at the limit of this known distribution.

21) Squirrel Glider – *Petaurus norfolcensis*

The squirrel glider occupies a sparse range along the east cost and immediate inland districts from western Victoria to north Queensland (NSW NPWS 1999j). This species generally inhabits dry sclerophyll forest and woodland, also being recorded from coastal and wet forests in the northern parts of NSW and Queensland (Suckling 2002). Preferred foraging habitat contains a regenerating understorey of eucalypts, wattles and flowering shrubs, allowing them to feed on arboreal invertebrates, eucalypt nectar, pollen and sap, and the seeds and gum of acacia species (NSW Scientific Committee 2000). Winter flowering species such as red ironbark, spotted gum and coastal banksia are particularly important when other food sources are limited. Family groups den in tree hollows, particularly in smooth-barked species (NSW NPWS 1999j). Home ranges typically vary between 0.65 and 8.55 hectares (NSW NPWS 1999j) although they can be significantly larger in less productive habitats, and a number of hollows will be used in rotation. Births occur throughout the year and can vary according to food availability (NSW NPWS1999j).

a) In the case of a threatened species, whether the life cycle of the species is likely to be disrupted such that a viable population of the species is likely to be placed at risk of extinction.

The squirrel glider was recorded during surveys of the project area in 2003. The species was identified along Lockyersleigh Creek in the north west of the project area, with four individuals including a juvenile recorded. The species was also tentatively recorded along Joarimin Creek. While the areas in which the squirrel glider was positively identified will be removed, the enhancement and protection of squirrel glider habitat across the project area will lessen the impact of clearing activities in the short term and provide foraging and den sites in the middle to long term. In particular, the formation of the Habitat Management Area, rehabilitation of the Joarimin Creek riparian corridor, erection of nest boxes and hollows salvaged from tree clearing operations, and implementation of a detailed clearing procedure will all mitigate the potential impact on this species. With these controls in place, the project is considered unlikely to disrupt the lifecycle of this species such that a viable population is likely to be placed at risk of extinction.

b) In the case of an endangered population, whether the lifecycle of the species that constitutes the endangered population is likely to be disrupted such that the viability of the population is likely to be significantly compromised.

No populations listed as endangered under the TSC Act 1995 are present within the project area.

c) In relation to the regional distribution of the habitat of a threatened species, population or ecological community, whether a significant area of known habitat is to be modified or removed.

The project will result in the removal of some known habitat for the squirrel glider, however, the majority of habitat will be retained. The establishment of the Habitat Management Area, rehabilitation of riparian corridors and the provision of nest boxes and re-erected tree hollows to provide required habitat structures will further reduce any impact. With these controls in place it is considered that the project will not result in the removal of a significant area of known habitat.

d) Whether an area of known habitat is likely to become isolated from currently interconnecting or proximate areas for a threatened species population or ecological community.

The project will remove an area of known habitat for the squirrel glider, however, the majority of habitat will be retained. The formation of the Habitat Management Area, rehabilitation of riparian corridors and strengthening of links between these areas will ensure that the project does not result in the isolation of any areas of known habitat.

e) Whether critical habitat will be affected.

No areas of critical habitat are present within the project area. There will be no loss of critical habitat for any threatened species, populations or ecological communities as a result of the project.

f) Whether a threatened species, population or ecological community, or their habitats are adequately represented in conservation reserves (or other similar protected areas) in the region.

This species has not been recorded from conservation reserves within a 50 kilometre radius of the project area. It is considered that neither this species, nor its habitat is adequately represented in conservation reserves in the region.

g) Whether the development or activity proposed is of a class of development or activity that is recognised as a threatening process.

Those Key Threatening Processes currently listed under Schedule 3 of the TSC Act 1995 with the potential to be relevant to this project include: clearing of native vegetation; bushrock removal; alteration to the natural flow regimes of rivers, streams, floodplains & wetlands; and removal of dead wood and dead trees.

h) Whether any threatened species, population or ecological community is at the limit of its known distribution.

The squirrel glider occupies a sparse range along the east cost and immediate inland districts from western Victoria to north Queensland (NSW NPWS 1999j). This species generally inhabits dry sclerophyll forest and woodland, also being recorded from coastal and wet forests in the northern parts of NSW and Queensland (Suckling 2002). The project area is not at the limit of this known distribution.

22) Grey-headed Flying-fox – *Pteropus poliocephalus*

The grey-headed flying fox species has been recorded along the eastern coastal plain from Bundaberg in Queensland, through NSW and south to eastern Victoria. It has also been recorded from Melbourne, some occurring west to Warrnambool (NSW Scientific Committee 2001c). Regular movements are made over the Great Dividing Range to the western slopes of NSW and Queensland. The species feeds on a variety of flowering and fruiting plants, including native figs and palms, blossoms from eucalypts, angophoras, tea-trees and banksias (Tidemann 2002). It plays an important role in seed dispersal (NSW NPWS 2001). Camps sites are usually formed in gullies, usually in vegetation with a dense canopy and not far from water (Tidemann 2002). Individuals generally exhibit a high fidelity to traditional camps and return annually to give birth and rear offspring (NSW Scientific Committee 2001c). Most births occur in September or October (Churchill 1998).

a) In the case of a threatened species, whether the life cycle of the species is likely to be disrupted such that a viable population of the species is likely to be placed at risk of extinction.

The grey-headed flying-fox was not recorded during surveys of the project area. The project area provides potential foraging habitat for this species in the form of flowering eucalypts and other flowering or fruiting native species. No camp habitat was recorded at the project area or in the general area. The project area does not contain habitat suitable for camp sites for this species. The project will result in the removal of some potential foraging habitat for this species, although the majority of habitat will be retained. The formation of the Habitat Management Area, rehabilitation of riparian zones and re-vegetation areas will ensure that this loss of potential foraging habitat is not significant. The project will not disrupt the lifecycle of this species such that a viable population is likely to be placed at risk of extinction.

b) In the case of an endangered population, whether the lifecycle of the species that constitutes the endangered population is likely to be disrupted such that the viability of the population is likely to be significantly compromised.

No populations listed as endangered under the TSC Act 1995 are present within the project area.

c) In relation to the regional distribution of the habitat of a threatened species, population or ecological community, whether a significant area of known habitat is to be modified or removed.

The project area is not known habitat for the grey-headed flying-fox. This species was not recorded during surveys of the project area. While there is potential foraging habitat for this species in the project area and some of this habitat will be removed, the majority of potential habitat will be retained and strengthened. A significant area of known habitat for this species will not therefore be modified by the project.

d) Whether an area of known habitat is likely to become isolated from currently interconnecting or proximate areas for a threatened species population or ecological community.

The project area does not form known habitat for the grey-headed flying-fox. There is, however, potential foraging habitat for this species in the project area. The project will result in the removal of areas of potential habitat for the species but due to the management and mitigation measures discussed above, will not result in a significant increase in isolation of available known habitat. The project will not result in an area of known habitat becoming isolated from currently interconnecting or proximate areas of habitat for the species.

e) Whether critical habitat will be affected.

No areas of critical habitat are present within the project area. There will be no loss of critical habitat for any threatened species, populations or ecological communities as a result of the project.

f) Whether a threatened species, population or ecological community, or their habitats are adequately represented in conservation reserves (or other similar protected areas) in the region.

This species has been recorded from one conservation reserve within a 50 kilometre radius of the site, that being Morton National Park (two records). It is considered unlikely that this species is adequately represented in conservation reserves in the region.

g) Whether the development or activity proposed is of a class of development or activity that is recognised as a threatening process.

Those Key Threatening Processes currently listed under Schedule 3 of the TSC Act 1995 with the potential to be relevant to this project include: clearing of native vegetation; bushrock removal; alteration to the natural flow regimes of rivers, streams, floodplains & wetlands; and removal of dead wood and dead trees.

h) Whether any threatened species, population or ecological community is at the limit of its known distribution.

This species has been recorded along the eastern coastal plain from Bundaberg in Queensland, through NSW and south to eastern Victoria. They have also been recorded in Melbourne, some occurring west to Warrnambool (NSW Scientific Committee 2001c). Regular movements are

made over the Great Dividing Range to the western slopes of NSW and Queensland. The project area is not at the limit of this known distribution.

23) Eastern Freetail-bat – *Mormopterus norfolkensis*

The eastern freetail-bat species has a distribution along the east coast of NSW from south of Sydney north into south east Queensland, near Brisbane (Churchill 1998). Most records are from dry eucalypt forest and woodland east of the Great Dividing Range. This species has also been recorded over a rocky river in rainforest and wet sclerophyll forest (Churchill 1998). Generally only solitary animals are recorded (Allison & Hoye 2002). This species generally roosts in tree hollows, however they have been recorded in roofs, under bark and the metal caps of telegraph poles (Churchill 1998). The species generally forages above the forest canopy, over water and also on the ground.

a) In the case of a threatened species, whether the life cycle of the species is likely to be disrupted such that a viable population of the species is likely to be placed at risk of extinction.

The eastern freetail-bat was tentatively recorded during surveys of the project area in 2004. The species was recorded by the Anabat II System with the level of confidence recorded as "possible". The project area provides large areas of potential foraging and breeding habitat for this species, particularly breeding habitat in the form of small tree hollows scattered across the project area. The relatively small area of habitat to be cleared in relation to habitat within the project area and the surrounding local and regional habitat, combined with a tree clearance protocol and nest box/hollow re-erection measures suggest that the impact of the project on the species will be minimal. The project will not therefore disrupt the lifecycle of this species such that a viable population is likely to be placed at risk of extinction.

b) In the case of an endangered population, whether the lifecycle of the species that constitutes the endangered population is likely to be disrupted such that the viability of the population is likely to be significantly compromised.

No populations listed as endangered under the TSC Act 1995 are present within the project area.

c) In relation to the regional distribution of the habitat of a threatened species, population or ecological community, whether a significant area of known habitat is to be modified or removed.

The project area is possible habitat of the eastern freetail-bat. Potential habitat for the eastern freetail-bat in the region includes areas of woodland distributed patchily within an approximate seven kilometre radius of the project area. To the south east beyond seven kilometres large areas of potentially suitable habitat exist in Morton National Park and to the north west along Cookbundoon Ranges. The project will result in a short term reduction in the amount of habitat for the species in the project area, however from a regional perspective this loss will be insignificant.

d) Whether an area of known habitat is likely to become isolated from currently interconnecting or proximate areas for a threatened species population or ecological community.

The project area is possibly known habitat for the eastern freetail-bat. The project will result in the removal of some of this habitat, however the majority of habitat will be retained and the connectivity of these areas strengthened through establishment of a habitat corridor. The project will not result in the isolation of any currently interconnecting or proximate areas.

e) Whether critical habitat will be affected.

No areas of critical habitat are present within the project area. There will be no loss of critical habitat for any threatened species, populations or ecological communities as a result of the project.

f) Whether a threatened species, population or ecological community, or their habitats are adequately represented in conservation reserves (or other similar protected areas) in the region.

This species has been recorded from one conservation reserve within a 50 km radius of the project area, that being Morton National Park (one record). It is considered unlikely that this species is adequately represented in conservation reserves in the region.

g) Whether the development or activity proposed is of a class of development or activity that is recognised as a threatening process.

Those Key Threatening Processes currently listed under Schedule 3 of the TSC Act 1995 with the potential to be relevant to this project include: clearing of native vegetation; bushrock removal; alteration to the natural flow regimes of rivers, streams, floodplains & wetlands; and removal of dead wood and dead trees.

h) Whether any threatened species, population or ecological community is at the limit of its known distribution.

This species has a distribution along the east coast of NSW from south of Sydney north into south east Queensland, near Brisbane (Churchill 1998). Most records are from dry eucalypt forest and woodland east of the Great Dividing Range. The project area is not at the limit of the known distribution for this species.

24) Eastern Bentwing-bat – *Miniopterus schreibersii oceanensis*

This species has an eastern distribution from Cape York along the coastal side of the Great Dividing Range and into the southern tip of South Australia (Churchill 1998). Habitat ranges widely, from rainforest, wet and dry sclerophyll forest, monsoon forest, open woodland, paperbark forests and open grasslands (Churchill 1998). It is cave-dwelling, congregating in maternity caves for breeding and later dispersing to satellite caves, generally within 300 kilometres (Churchill 1998), and it hibernates over winter in southern parts of its range (Churchill 1998). It has been recorded roosting in a variety of man-made structures including buildings and culverts (Dwyer 1995b). A single young is born in December (Churchill 1998).

a) In the case of a threatened species, whether the life cycle of the species is likely to be disrupted such that a viable population of the species is likely to be placed at risk of extinction.

The eastern bentwing-bat was recorded during surveys of the project area in 2003 and 2004. The project area provides large areas of foraging habitat for this species. Potential roost habitat in the form of suitable caves were not recorded within the project area. The relatively small area of habitat to be cleared in relation to the surrounding local and regional habitat plus the proposed habitat management and re-establishment measures suggests that the impact of the project on the species will be minimal. The project will not disrupt the lifecycle of this species such that a viable population is likely to be placed at risk of extinction.

b) In the case of an endangered population, whether the lifecycle of the species that constitutes the endangered population is likely to be disrupted such that the viability of the population is likely to be significantly compromised.

No populations listed as endangered under the TSC Act 1995 are present within the project area.

c) In relation to the regional distribution of the habitat of a threatened species, population or ecological community, whether a significant area of known habitat is to be modified or removed.

The project area is known habitat for the eastern bentwing-bat. While the project area provides foraging habitat for this species and part of this habitat will be removed, the majority of habitat will be retained and strengthened. No roosting or breeding habitats will be impacted. A significant area of known habitat for this species will not therefore be modified by the project.

d) Whether an area of known habitat is likely to become isolated from currently interconnecting or proximate areas for a threatened species population or ecological community.

The project area is known habitat for the eastern bentwing-bat. The project will result in the removal of areas of foraging habitat for the species, however, the majority of habitat will be retained. Existing connectivity will be retained and enhanced. The project will not result in an area of known habitat becoming isolated from currently interconnecting or proximate areas of habitat for the species.

e) Whether critical habitat will be affected.

No areas of critical habitat are present within the project area. There will be no loss of critical habitat for any threatened species, populations or ecological communities as a result of the project.

f) Whether a threatened species, population or ecological community, or their habitats are adequately represented in conservation reserves (or other similar protected areas) in the region.

This species has been recorded from one conservation reserve within a 50 kilometre radius of the site, that being Bungonia State Conservation Area (three records). It is considered unlikely that this species is adequately represented in conservation reserves in the region.

g) Whether the development or activity proposed is of a class of development or activity that is recognised as a threatening process.

Those Key Threatening Processes currently listed under Schedule 3 of the TSC Act 1995 with the potential to be relevant to this project include: clearing of native vegetation; bushrock removal; alteration to the natural flow regimes of rivers, streams, floodplains & wetlands; and removal of dead wood and dead trees.

h) Whether any threatened species, population or ecological community is at the limit of its known distribution.

This species has an eastern distribution from Cape York along the coastal side of the Great Dividing Range, and into the southern tip of South Australia (Churchill 1998). The project area is not at the limit of the known distribution of this species.

25) Eastern False Pipistrelle – *Falsistrellus tasmaniensis*

The eastern false pipistrelle has a range from south eastern Queensland, through NSW and Victoria and into Tasmania (Churchill 1998). Habitat includes sclerophyll forest from the Great Dividing Range to the coast. They appear to prefer wet habitats, with trees over 20 metres high (Churchill 1998). It generally roosts in tree hollows or trunks, in groups of 6 to 36, although it has been occasionally recorded from caves or buildings (Churchill 1998). It appears to hibernate over winter in southern parts of its range (Phillips 1995), and a single young is born in December (Churchill 1998).

a) In the case of a threatened species, whether the life cycle of the species is likely to be disrupted such that a viable population of the species is likely to be placed at risk of extinction.

The eastern false pipistrelle was tentatively recorded during surveys of the project area in 2004. The species was recorded by the Anabat II System with a level of confidence of “possible”. The project area provides large areas of potential habitat for this species, particularly in the form of small tree hollows. The relatively small area of habitat to be cleared in relation to the habitat within the local project area and the surrounding local and regional habitat, combined with a tree clearance protocol and nest box/hollow re-erection measures suggest that the impact of the project on the species will be minimal. The project will not disrupt the lifecycle of this species such that a viable population is likely to be placed at risk of extinction.

b) In the case of an endangered population, whether the lifecycle of the species that constitutes the endangered population is likely to be disrupted such that the viability of the population is likely to be significantly compromised.

No populations listed as endangered under the TSC Act 1995 are present within the project area.

c) In relation to the regional distribution of the habitat of a threatened species, population or ecological community, whether a significant area of known habitat is to be modified or removed.

The project area is possible habitat of the eastern false pipistrelle. Habitat for this species across the project area, namely woodland and riparian vegetation is distributed across the region, particularly woodland habitats in Morton National Park and Bungonia State Conservation

Area. The majority of habitat within the project area will also be unaffected by the project. A significant area of known habitat for this species will not be modified by the project.

d) Whether an area of known habitat is likely to become isolated from currently interconnecting or proximate areas for a threatened species population or ecological community.

The project area is possible habitat of the eastern false pipistrelle. The project will result in the removal of some areas of habitat for the species but the majority of habitat will be retained and the project will not result in a significant increase in isolation of available known habitat. The project will not result in an area of known habitat becoming isolated from currently interconnecting or proximate areas of habitat for the species.

e) Whether critical habitat will be affected.

No areas of critical habitat are present within the project area. There will be no loss of critical habitat for any threatened species, populations or ecological communities as a result of the project.

f) Whether a threatened species, population or ecological community, or their habitats are adequately represented in conservation reserves (or other similar protected areas) in the region.

This species has not been recorded from conservation reserves within a 50 kilometre radius of the project area. It is considered unlikely that this species is adequately represented in conservation reserves in the region.

g) Whether the development or activity proposed is of a class of development or activity that is recognised as a threatening process.

Those Key Threatening Processes currently listed under Schedule 3 of the TSC Act 1995 with the potential to be relevant to this project include: clearing of native vegetation; bushrock removal; alteration to the natural flow regimes of rivers, streams, floodplains & wetlands; and removal of dead wood and dead trees.

h) Whether any threatened species, population or ecological community is at the limit of its known distribution.

This species has a range from south eastern Queensland, through NSW and Victoria and into Tasmania (Churchill 1998). Habitat includes sclerophyll forest from the Great Dividing Range to the coast. The project area is not at the limit of the known distribution for this species.

26) Large-eared Pied Bat – *Chalinolobus dwyeri*

The large-eared pied bat has a distribution from south-western Queensland to NSW from the coast to the western slopes of the Great Dividing Range (Churchill 1998). It is generally found in a variety of drier habitats, including the dry sclerophyll forests and woodlands, however probably tolerates a wide range of habitats (Hoye & Dwyer 1995). It probably forages for small insects below the forest canopy (Hoye & Dwyer 1995). The species tends to roost in the twilight zones of mines and caves, generally in colonies or in common groups (Churchill 1998). Females give

birth (generally to twins) in November, with independence achieved by February (Churchill 1998).

a) In the case of a threatened species, whether the life cycle of the species is likely to be disrupted such that a viable population of the species is likely to be placed at risk of extinction.

The large-eared pied bat was not recorded during surveys of the project area. The project area provide large areas of potential foraging habitat for this species, although potential roost habitat in the form of suitable caves was not recorded within the project area. The project will result in the removal of some potential foraging habitat for this species although the majority of potential habitat will be retained and enhanced. The project will not disrupt the lifecycle of this species such that a viable population is likely to be placed at risk of extinction.

b) In the case of an endangered population, whether the lifecycle of the species that constitutes the endangered population is likely to be disrupted such that the viability of the population is likely to be significantly compromised.

No populations listed as endangered under the TSC Act 1995 are present within the project area.

c) In relation to the regional distribution of the habitat of a threatened species, population or ecological community, whether a significant area of known habitat is to be modified or removed.

The project area is not known habitat for the large-eared pied bat. While there is potential foraging habitat for this species in the project area and some of this potential habitat will be impacted, the majority of habitat will be retained. A significant area of potential habitat for this species will not therefore be modified by the project.

d) Whether an area of known habitat is likely to become isolated from currently interconnecting or proximate areas for a threatened species population or ecological community.

The project area is not known habitat for the large-eared pied bat. The project will result in the removal of some areas of potential habitat for the species but the majority of habitat will be retained and the project will not result in a significant increase in isolation of available known habitat. The project will not result in an area of known habitat becoming isolated from currently interconnecting or proximate areas of habitat for the species.

e) Whether critical habitat will be affected.

No areas of critical habitat are present within the project area. There will be no loss of critical habitat for any threatened species, populations or ecological communities as a result of the project.

f) Whether a threatened species, population or ecological community, or their habitats are adequately represented in conservation reserves (or other similar protected areas) in the region.

This species has been recorded from one conservation reserve within a 50 kilometre radius of the site, that being Morton National Park (two records). It is considered unlikely that neither this species is adequately represented in conservation reserves in the region.

g) Whether the development or activity proposed is of a class of development or activity that is recognised as a threatening process.

Those Key Threatening Processes currently listed under Schedule 3 of the TSC Act 1995 with the potential to be relevant to this project include: clearing of native vegetation; bushrock removal; alteration to the natural flow regimes of rivers, streams, floodplains & wetlands; and removal of dead wood and dead trees.

h) Whether any threatened species, population or ecological community is at the limit of its known distribution.

The large-eared pied bat has a distribution from south-western Queensland to NSW from the coast to the western slopes of the Great Dividing Range (Churchill 1998). The project area is not at the limit of this known distribution.

APPENDIX D

EPBC Act Assessment of Significance

Appendix D – Assessment of Significance under the *Environmental Protection and Biodiversity Conservation Act* 1999

A search of the EPBC Protected Matters database (7 February 2005) identified 11 threatened fauna species (discounting marine species) and six migratory species (discounting marine species) known to occur, or considered likely to occur, on the basis of habitat modelling, within 10 kilometres of the project area. Five listed flora species were also identified. **Table 1** lists the threatened species potentially occurring in the project area and considered in the assessment of significance. No listed threatened species were recorded in the project area during ecological investigations.

Table 1 - Listed Threatened Species Potentially Occurring in Project Area

Scientific Name	Common Name
Fauna	
Heleioporus australiacus	giant burrowing frog
Delma impar	striped legless lizard
Lathamus discolor	swift parrot
Xanthomyza phrygia	regent honeyeater
Dasyurus maculatus	spotted-tailed quoll
Pteropus poliocephalus	grey-headed flying fox
Chalinolobus dwyeri	large-eared pied bat
Flora	
Caladenia tessellata	thick-lipped spider orchid
Diuris aequalis	buttercup doubletail
Genoplesium plumosum	plumed midge-orchid
Haloragis exalata subsp. *exalata*	wingless raspwort
Kunzea cambagei	

The endangered ecological communities Temperate Grassland and Grassy White Box Woodland were also considered in the assessment.

Assessment of Significance for Listed Threatened Species

An action will require approval from the Environment Minister if the action has, will have, or is likely to have a significant impact on listed threatened species and ecological communities. Assessment under the *Environment Protection and Biodiversity Conservation Act* 1999 (EPBC Act), indicates that the project will not modify, destroy or isolate an area of 'important habitat' for identified or potentially occurring threatened or migratory species, as demonstrated below.

An important population of a threatened species is one that is necessary for the species' long-term survival and recovery. This may include populations that are:

- key source populations either for breeding or dispersal,
- populations that are necessary for maintaining genetic diversity, and/or
- populations that are near the limit of the species range.

An action has, will have, or is likely to have a significant impact on threatened species if it does, will, or is likely to:

- **lead to a long-term decrease in the size of an important population of a species;**

No listed threatened species were recorded in the project area and no important populations of threatened species are expected to occur. The project will not lead to a long-term decrease in the size of an important population of any threatened species.

- **reduce the area of occupancy of an important population, or;**

The project will result in the loss of approximately 100 hectares of woodland which provides potential but not known habitat of any threatened species. The project area does not support an important population of any threatened species and the project will not result in the significant reduction in the area of occupancy available for these species.

- **fragment an existing important population into two or more populations, or;**

No important population was identified in the project area and no important population is likely to occur. The project will not lead to the fragmentation of an existing important population into two or more populations.

- **adversely affect habitat critical to the survival of a species, or;**

The EPBC Act administrative guidelines describes habitat critical to the survival of a species or ecological community as areas that are necessary:

  - for activities such as foraging, breeding, roosting, or dispersal,
  - for succession,
  - to maintain genetic diversity and long term evolutionary development, or
  - for the reintroduction of populations or recovery of the species / community.

The habitats occurring within the project area are not considered to form critical habitat which is essential to the survival of any threatened species.

- **disrupt the breeding cycle of an important population, or;**

The project area is not considered to support important breeding habitat for any of the potentially occurring listed threatened species. As such, the project is not expected to disrupt the breeding cycle of an important population.

- **modify, destroy, remove or isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline, or;**

Based on a habitat assessment undertaken for the project area, it is not considered to be significant habitat for any of the threatened species potentially occurring in the local area. As such, the project is not expected to result in habitat loss that will cause the potentially occurring species to decline.

- **result in invasive species that are harmful to a vulnerable species becoming established in the vulnerable species' habitat, or;**

The project is not expected to result in the introduction of any non-endemic species which may be detrimental to any vulnerable species or their habitat.

- **interferes substantially with the recovery of the species.**

The proposal will not result in the loss of important habitat for any threatened species, and is not expected to substantially interfere with the recovery of any threatened species potentially occurring in the local area.

Assessment of Significance for Listed Migratory Species

An action will require approval from the Environment Minister if the action has, will have, or is likely to have a significant impact on a listed migratory species. The survey undertaken in the project area identified seven listed migratory species, as listed in **Table 2**.

Table 2 - Listed Migratory Species recorded within the Project Area

FAMILY / *Scientific Name*	**Common Name**
ACCIPITRIDAE	
Aquila audax	wedge-tailed eagle
Accipiter fasciatus	brown goshawk
ANATIDAE	
Chenonetta jubata	Australian wood duck
Anas superciliosa	Pacific black duck
Anas gracilis	grey teal
FALCONIDAE	
Falco longipennis	Australian hobby
Falco cenchroides	nankeen kestrel

Assessment under the EPBC Act 1999 indicates that the project will not modify, destroy or isolate an area of 'important habitat' for identified or potentially occurring migratory species, as discussed below.

Important habitat is defined under the EPBC Act 1999 as:

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

An action has, will have, or is likely to have a significant impact on a migratory species if it does, will, or is likely to:

- **substantially modify (including by fragmenting, altering fire regimes, altering nutrient cycles or altering hydrological cycles), destroy or isolate an area of important habitat of the migratory species, or**

The project area does not contain important habitat for the seven migratory species recorded in the project area. The project will not modify, destroy or isolate any important area of habitat for the identified species, with much of the habitat existing in the project area to be retained and enhanced.

- **result in invasive species that is harmful to the migratory species becoming established in an area of important habitat of the migratory species, or**

The project will not result in the introduction of invasive species. The Property Management Plan proposed as part of the project will ensure that invasive species such as the fox and feral cat will be managed, resulting in decreased predation of migratory species.

- **seriously disrupt the lifecycle (breeding, feeding, migration or resting behaviour) of an ecologically significant proportion of the population of the species.**

The project area does not support an ecologically significant proportion of the migratory species identified during fauna surveys in the project area. The project will not seriously disrupt the lifecycle of the identified species. Significant areas of habitat will be retained and managed within the project area and there will be a net gain of waterbody habitat for Anatidae species recorded.

APPENDIX E

Revegetation Species List

Appendix E – Revegetation Species List

Family/Subfamily	*Scientific Name*	Common Name	Tableland Grassy Box-Gum Woodland	Tableland Low Woodland	Western Tablelands Dry Forest	Riparian Gum-Box-Apple Woodland	Camden Woollybutt Low Open Woodland
JUNCACEAE	*Juncus usitatus*	a rush				X	
LOMANDRACEAE	*Lomandra longifolia*	spiny-headed mat-rush				X	
LOMANDRACEAE	*Lomandra obliqua*	twisted mat-rush	X				
POACEAE	*Aristida ramosa*	wire grass	X	X	X	X	X
POACEAE	*Austrodanthonia laevis (syn. Danthonia laevis)*	a wallaby grass	X	X	X	X	X
POACEAE	*Austrodanthonia racemosa* var. *racemosa (syn. Danthonia racemosa var. racemosa)*	white top	X	X	X	X	X
POACEAE	*Austrodanthonia tenuior (syn. Danthonia tenuior)*	a wallaby grass	X	X	X	X	X
POACEAE	*Austrostipa scabra* subsp. *falcata (syn. Stipa scabra ssp. falcata)*	speargrass	X	X	X	X	X
POACEAE	*Austrostipa scabra* subsp. *scabra (syn. Stipa scabra ssp. Scabra)*	corkscrew grass	X	X	X	X	X
POACEAE	*Cynodon dactylon*	couch	X	X	X	X	X
POACEAE	*Dichelachne micrantha*	shorthair plumegrass	X	X	X	X	X
POACEAE	*Echinopogon caespitosus* var. *caespitosus*	tufted hedgehog grass	X	X	X	X	X
POACEAE	*Elymus scaber*	wheatgrass	X	X	X	X	X
POACEAE	*Entolasia marginata*	bordered panic		X			
POACEAE	*Eragrostis brownii*	Brown's lovegrass	X	X	X	X	X
POACEAE	*Microlaena stipoides* var. *stipoides*	weeping grass	X	X	X	X	X
POACEAE	*Poa sieberiana*	snow grass	X	X	X	X	X
POACEAE	*Themeda australis*	kangaroo grass	X	X	X	X	X

Family/Subfamily	*Scientific Name*	Common Name	Tableland Grassy Box-Gum Woodland	Tableland Low Woodland	Western Tablelands Dry Forest	Riparian Gum-Box-Apple Woodland	Camden Woollybutt Low Open Woodland
XANTHORRHOEACEAE	*Xanthorrhoea glauca* subsp. *angustifolia*			X			
Magnoliopsida (Flowering Plants) – Magnoliidae (Dicots)							
ASTERACEAE	*Olearia viscidula*	wallaby weed	X	X	X		
CASUARINACEAE	*Allocasuarina littoralis*	black sheoak	X	X	X		
CHENOPODIACEAE	*Einadia trigonos*	fishweed	X	X	X	X	X
DILLENIACEAE	*Hibbertia obtusifolia* complex	hoary guinea flower	X	X	X		
EPACRIDACEAE	*Leucopogon muticus*	blunt beard-heath	X	X	X		
EPACRIDACEAE	*Lissanthe strigosa*	peach heath	X	X	X		
EPACRIDACEAE	*Melichrus erubescens*	ruby urn heath	X	X	X		
EUPHORBIACEAE	*Phyllanthus virgatus*	a spurge	X	X	X	X	X
FABACEAE - FABOIDEAE	*Hardenbergia violacea*	false sarsaparilla	X	X	X	X	X
FABACEAE - MIMOSOIDEAE	*Acacia brownii*	prickly Moses	X	X	X	X	X
FABACEAE - MIMOSOIDEAE	*Acacia decurrens*	black wattle	X	X	X	X	X
FABACEAE - MIMOSOIDEAE	*Acacia mearnsii*	black wattle	X	X	X	X	X
FABACEAE - MIMOSOIDEAE	*Acacia obtusata*			X			
FABACEAE - MIMOSOIDEAE	*Acacia stricta*	straight wattle			X		
GERANIACEAE	*Geranium solanderi* var. *solanderi*	native geranium	X	X	X	X	X
GOODENIACEAE	*Goodenia hederacea* subsp. *hederacea*	ivy goodenia	X	X	X	X	X
MYRTACEAE	*Eucalyptus agglomerata*	blue-leaved stringybark	X	X	X	X	
MYRTACEAE	*Eucalyptus amplifolia* subsp. *amplifolia*	cabbage gum				X	
MYRTACEAE	*Eucalyptus blakelyi*	Blakely's red gum	X				
MYRTACEAE	*Eucalyptus bridgesiana*	apple box				X	
MYRTACEAE	*Eucalyptus cinerea*	Argyle apple		X		X	

Family/Subfamily	*Scientific Name*	Common Name	Tableland Grassy Box-Gum Woodland	Tableland Low Woodland	Western Tablelands Dry Forest	Riparian Gum-Box-Apple Woodland	Camden Woollybutt Low Open Woodland
MYRTACEAE	*Eucalyptus dives*	broad-leaved peppermint					X
MYRTACEAE	*Eucalyptus eugenioides*	thin-leaved stringybark			X		
MYRTACEAE	*Eucalyptus globoidea - eugenioides*				X		
MYRTACEAE	*Eucalyptus goniocalyx*	bundy	X	X	X		
MYRTACEAE	*Eucalyptus macarthurii*	Camden woollybutt					X
MYRTACEAE	*Eucalyptus macrorhyncha*	red stringybark	X	X	X	X	X
MYRTACEAE	*Eucalyptus mannifera* subsp. *mannifera*	brittle gum		X			
MYRTACEAE	*Eucalyptus melliodora*	yellow box	X			X	
MYRTACEAE	*Eucalyptus moluccana*	grey box				X	
MYRTACEAE	*Eucalyptus ovata*	swamp gum				X	
MYRTACEAE	*Eucalyptus radiata*	narrow-leaved peppermint				X	
MYRTACEAE	*Eucalyptus rossii*	inland scribbly gum				X	
MYRTACEAE	*Kunzea parvifolia*		X	X	X		
MYRTACEAE	*Leptospermum polygalifolium*	yellow tea tree				X	
MYRTACEAE	*Leptospermum trinervium*	flaky-barked tea tree	X	X	X	X	
PITTOSPORACEAE	*Bursaria spinosa* subsp. *spinosa (syn. B. spinosa var. spinosa)*	blackthorn	X	X	X	X	
PROTEACEAE	*Persoonia linearis*	narrow-leaved geebung	X	X	X		
ROSACEAE	*Acaena novae-zelandiae*	bidgee-widgee	X	X	X	X	X
SANTALACEAE	*Exocarpos cupressiformis*	native cherry	X	X	X	X	
SCROPHULARIACEAE	*Veronica plebeia*	trailing speedwell	X	X	X	X	X

Umwelt (Australia) Pty Limited
2/20 The Boulevarde
PO Box 838
Toronto NSW 2283
Ph. 02 4950 5322
Fax 02 4950 5737
www.umwelt.com.au