Huntingdale Developments Pty Ltd

Proposed Rezoning, Wyalla Road, Jamberoo

Flora and Fauna Assessment

January 2012

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Executive Summary

OMVI Ecological has been commissioned by Huntingdale Developments Pty Ltd to undertake a flora and fauna impact assessment for a proposed rezoning of Lot 100 DP 1063277, Jamberoo. This follows a flora and fauna impact assessment conducted by Bushfire Environmental Services in 2005. This assessment is being conducted concurrently with the adjoining Lot 1, DP 781781, Wyalla Road, for Mrs Colleen Camarda, which would be included in the rezoning and subsequent residential development if approved.

The primary objectives of this study were to assess the potential likely impacts of the proposed rezoning and subsequent residential sub-division on threatened species, migratory species, and endangered populations and ecological communities or their habitats and to determine the most appropriate mitigation measures to be incorporated into design to avoid or minimise the potential for significant adverse impacts on the natural environment. A range of additional impact mitigation and environmental management measures have also been identified which could be implemented during the various stages of the development to further minimise impacts on native biota and their habitats.

The ecological assessment involved a detailed review of existing information (including previous flora and fauna reports and wildlife databases) and dedicated flora and fauna field surveys, including terrestrial habitat assessments and targeted searches for threatened species. Field investigations were conducted throughout the project subject site and on adjoining lands. The surveys were specifically timed to maximise the chance of detecting a representative suite of species, which occur in the area, especially more cryptic threatened flora and fauna species.

Two threatened species, the Greater Broad-nosed Bat and potentially the Large Footed Myotis have been recorded within the study area. The subject site was also found to contain a small heavily disturbed remnant of the endangered ecological community Illawarra Subtropical Rainforest along part of Hyams Creek. No threatened flora species or endangered populations listed on the schedules of the *NSW Threatened Species Conservation Act 1995* or the *Commonwealth Environment Protection and Biodiversity Conservation Act 1999* were recorded in the study area. Two (2) migratory species were recorded foraging on or near the study area.

An assessment of significance pursuant to Section 5A of the *NSW Environmental Planning & Assessment Act 1979* was carried out for both the threatened bats recorded and Illawarra Sub-tropical Rainforest. All assessments concluded that a future residential development proposal would be unlikely to have a significant effect and that a Species Impact Statement is not required.

Assessments, according to the Administrative Guidelines provided for assessment of actions under the EPBC Act, have concluded that the proposed rezoning for a residential development is unlikely to have a significant effect on threatened fauna or migratory species listed pursuant to the EPBC Act, (that have been recorded or which could potentially occur in the study area.) The remaining “matters of national environmental significance” listed pursuant to the EPBC Act are not of relevance to the study site. On the basis of the above considerations, a future residential sub-division is not likely to have a significant impact on a matter of national environmental significance, and that a referral to the Commonwealth Environment Minister is not required.

Nevertheless, a number of practices/measures were recommended to ameliorate any potential impacts of a future residential development proposal on flora and fauna.

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Report Definitions

Development **-** the use of land, the subdivision of land, the erection of a building, the carrying out of a work, the demolition of a building or work and any other matter referred to in S26 of the Act and which is controlled by an environmental planning instrument.

Direct impacts - are those that directly affect habitat and individuals, usually within the footprint of the proposal. They include, but are not limited to, clearing and habitat removal. (DEC 2005).

Indirect impacts - occur when project-related activities affect resources in a manner other than a direct loss of the resource. Indirect impact may include but are not limited to: killing the species through starvation, exposure, predation by domestic and/or feral animals, loss of breeding opportunities, shade/shelter, increased soil salinity, promotion of erosion, provision of suitable seed bed for exotic weed invasion, or increased human activity within or directly adjacent to sensitive habitat areas (DEC 2005)

LGA – Local government area

Local occurrence **-** means the ecological community that occurs within the study area.

Local population **-** is the population that occurs in the study area.

Local population of resident fauna comprises those individuals known or likely to occur in the study area, as well as any individuals occurring in adjoining areas that are known or likely to occur in the subject site from time to time.

Local population of threatened plant species comprises those individuals occurring in the subject site or the cluster of individuals that extend into habitat adjoining and contiguous with the subject site that could reasonably be expected to be cross-pollinating with those in the study area.

Locality **-** is an area within a 10 km radius of the subject site.

Proposal **-** is the development, activity or action proposed.

Region – is an area approximating the Kiama Local Government Area but restricted to the Sydney Basin Bioregion.

Risk of extinction **-** is the likelihood that the local population of the species or local occurrence of the endangered population or ecological community will become extinct either in the short term, medium term or long-term as a result of direct or indirect impacts on the viability of that population and includes changes to the ecological function of communities.

Subject site **-** is the subject site and any additional areas that are likely to be affected by the proposal, either directly or indirectly.

Subject species, populations or ecological communities **-** means those threatened species, populations or ecological communities that are known or are considered likely to occur in the study area.

Viable **-** is the capacity to successfully complete each stage of the life cycle under normal conditions**.**

1. Introduction

Lot 100 DP 1063277 Wyalla Road Jamberoo is currently zoned as 1 (a) (Rural "A") under the Kiama LEP 1996 and part is proposed to be rezoned for residential purposes. Lot 100 has a total area of approximately 7.8 ha and its location is shown in Figure 1. This assessment is being conducted concurrently with the adjoining Lot 1, DP 781781, Wyalla Road, for Mrs Colleen Camarda, which would be included in the rezoning and subsequent residential development if approved. Lot 1 has a total area of approximately 1.6 ha and its location is shown in Figure 1. The total area under investigation therefore is approximately 9.4 hectares

Whilst there is no detailed residential development proposal at this stage, this report assesses the scenario whereby the entirety of the subject site including Lot 100 and Lot 1 is developed for residential purposes, with the exception of Hyams Creek and a riparian buffer. It is assumed that the Hyams Creek 'corridor' will be protected by a riparian buffer zone between 5-10 metres wide, from which direct and indirect disturbances will generally be excluded.

This report follows a similar assessment conducted by BES in 2005 and incorporates the data collated in this report and updated database and literature reviews, field surveys and analysis conducted by OMVI in September 2011.

1.1 Background

1.1.1 Description of subject site

The subject site for the purposes of this report is the entirety of Lot 100 and the adjacent Lot 1, which are located on the western fringe of the existing residential area of Jamberoo. Apart from a small crown reserve along Hyams Creek the subject site is surrounded by freehold lands that have been developed for rural or residential landuses. The location of the subject site is shown in Figure 1.

1.1.2 Biogeographical, Botanical and Zoogeographic Region (IBRA)

The Project area is located in the Illawarra sub-region of the Sydney Basin Interim Biogeographic Regionalisation of Australia (IBRA) bioregion (Commonwealth Department of the Environment, Water, Heritage and Arts (DEWHA, 2009). The Sydney Basin Bioregion lies on the central east coast of NSW and covers an area of approximately 3,632,890 hectares. It occupies about 4.53% of NSW and is one of two bioregions contained wholly within the State. The bioregion extends from just north of Batemans Bay to Nelson Bay on the central coast, and almost as far west as Mudgee. As well as Sydney itself, the Sydney Basin bioregion encompasses the towns of Wollongong, Nowra, Newcastle, Cessnock, Muswellbrook and the Blue Mountains towns such as Katoomba and Mount Victoria. It includes a significant or greater proportion of the catchments of the Hawkesbury-Nepean, Hunter and Shoalhaven river systems, all of the smaller catchments of Lake Macquarie, Lake Illawarra, Hacking, Georges and Parramatta Rivers, and smaller portions of the headwaters of the Clyde and Macquarie Rivers (Figure 1).

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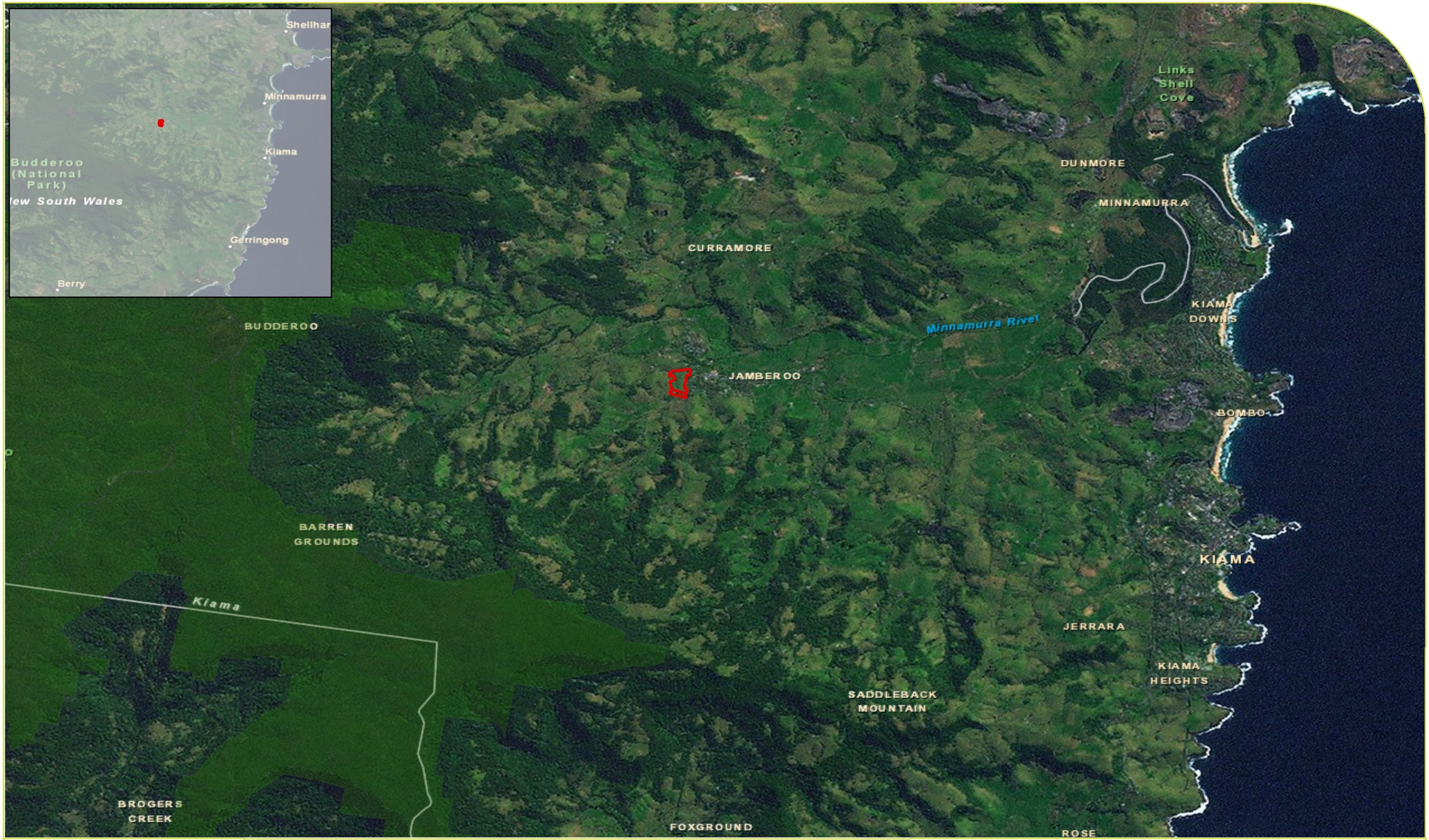

Figure 1: Location of the Subject Site

The bioregion generally can be considered in moderate condition, however there is great variation at the sub-regional level. Impacts from clearing, agricultural, urban and industrial development, exotic weeds, grazing, pollution, mining and changed fire regimes have all had a severe impact on many parts of the landscape. Many large areas within the bioregion are still in near pristine condition largely due to inaccessibility and being inappropriate for agricultural development. There are other areas however, which have been severely modified due to the urban expanse of the greater metropolitan area of Sydney and mining practices in the hunter region. Despite this over 35% of the bioregion is reserved for conservation making the Sydney Basin one of the best reserved bioregions in NSW.

The Sydney Basin Bioregion is one of the most species diverse in Australia. This is a result of the variety of rock types, topography and climates in the bioregion. Along the coastal fringe dry sclerophyll frontal dune ecosystems and estuarine communities, including salt and freshwater wetlands and mangroves remain dynamic due to present day alluvial, geomorphic and marine processes continue to alter the deposited sands and alluvium. Subtropical and littoral Rainforest communities and the adjacent tall forests below the surrounding sandstone escarpments are nourished by orographic rainfall, supporting a diverse group of floral and faunal species. These Coastal forests often occupy shale-derived soils, capping sandstone and along the coastal ramp. Drier, lowland environments, such as the upper Hunter, Cerrabee and Cumberland Plains support drier forests and woodlands with a more open canopy and understorey. While the species composition and the structural form of the vegetation communities occupying extensive sandstone plateaus vary with altitude and rainfall. From hanging swamps and heaths to taller forest and woodlands biodiversity in these ecosystems is great.

Falling on the coastal ramp along boundary of the Lake Illawarra Alluvial Plains and the Kiama Coastal Slopes (Mitchell Landscapes) the current subject site comprises of both coastal forest and woodland with varying influences of sandstone and shales.

1.1.3 Topography, Geology, and Soils

The subject site lies at an elevation of between approximately 8 m and 30 m Australian Height Datum (AHD) adjacent to Hyams Creek which, is in the catchment of the Minnamurra River. The northern and western subject site boundary is defined by the Hyams Creek channel (Figure 2). Hyams Creek is a perennial watercourse that feeds Terragong Swamp to the east. The subject site is generally flat with gentle up-slopes to the south-east towards Wyalla Road, particularly in the southern parts of the subject site and in Lot 1. The aspect of the subject site is predominantly north through north-west and west.

The Kiama 1:50,000 Geology map indicates that the subject site is underlain by quaternary alluvium in the lower parts adjacent to Hyams Creek and the red-brown and grey volcanic sandstones of the Budgong Sandstone of the Shoalhaven Group in the high parts. Surveying for this report indicates that the Budgong Sandstone also outcrops in the Hyams Creek Channel.

The subject site supports swamp landscapes of the Killalea soil landscape in the lower parts of the study area. Killalea soil landscapes occur on level to gently inclined alluvial plains and swamps and generally include up to 30 cm of organic black massive sandy loam overlying < 20 cm of loose bleached light grey sand with iron staining. The higher parts of the subject site support depositional landscapes of the Fountaindale soil landscape which generally comprise up to 10 cm of hard-setting brownish black sandy clay over < 15 cm of greyish brown sandy clay, which overlies either < 40 cm of brown medium clay or < 40 cm of brown medium clay with mottles (Hazelton 1992).

1.2 The Proposal

The proposal involves the rezoning of the subject site for residential purposes. For the purposes of this report it is assumed that the proposed rezoning and potential future development of the subject site will result in disturbances across the entire area with the exception of the vegetation and habitats within the Hyams Creek channel and adjacent banks and buffer. The proposal also includes creating and enhancing a riparian corridor between 5 and 10 metres from the creek to promote landscape connectivity and help stabilising the currently fragile bank of Hyams Creek.

1.3 Aim and Objectives

The aim of this investigation was to assess the ecological impact on the flora, fauna and habitats of the study subject site, of future residential development proposals in the context of the proposed rezoning of the subject site for residential purposes.

Assuming that the subject site will be developed for residential purposes, the objectives of this investigation were:

- to identify and describe the flora species and vegetation communities present in the subject site and their conservation significance;
- to identify and describe the fauna habitats present in the subject site and their condition;
- to identify the fauna species which are present or likely to occur in the study area, and their conservation significance;
- to assess the impacts on vegetation, fauna, habitats, and other environmental features as necessary;
- to determine whether there is likely to be a significant effect on threatened species, endangered populations or endangered ecological communities, or their habitats, pursuant to Section 5A of the *NSW Environmental Planning and Assessment Act 1979* as required by the *NSW Threatened Species Conservation Act 1995*;
- to determine whether there is likely to be a significant effect on threatened species, endangered populations or endangered ecological communities, or their habitats, pursuant to Section 5A of the *NSW Environmental Planning and Assessment Act 1979* as required by the *NSW Fisheries Management Act 1994*;
- to determine whether the subject site harbours elements of any state planning policy such as potential *NSW State Environmental Planning Policy No. 44 – Koala Habitat Protection*;
- to determine whether the proposed rezoning and likely future residential development involves an action that has, will have, or is likely to have, a significant impact on a matter of national environmental significance under the *Commonwealth Environment Protection and Biodiversity Conservation Act 1999*; and
- to make recommendations regarding any environmental management and impact mitigation/amelioration measures, which can be implemented to limit the effects of the proposal on vegetation, fauna, habitats, and other environmental features as necessary

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Figure 2: Subject Site (Lots 1 and 100 Whyalla Road Jamberoo)

2. Methods

2.1 Databases Searches

Databases and other information sources such as:

- NSW OEH: *Atlas of NSW Wildlife;*
- DSEWPC *Protected Matters Search Tool* covering Threatened Species and Communities, and Migratory and Other Species under the EPBC Act; and
- Published vegetation mapping such as the SCIVI mapping conducted by Tozer *et al. 2006,* which have compiled vegetative information relation to the vegetation types and communities of the subject site and surrounds.

2.2 Identifying subject species/communities

An assessment of the presence or absence of threatened species, populations, ecological communities or critical habitat possibly occurring or determined as subject species are summarised Table 3 below. Detailed assessments are given in Table 11 and Table 12 (Appendix B).

2.2.1 Threatened ecological communities

Seventeen (17) Threatened Ecological Communities (TEC) are listed within Kiama district and surrounding LGA's (Atlas of Wildlife, Tozer *et al.* 2006) (Table 3). Table 11 (Appendix B) details the likelihood of the presence of any EEC within the study area and highlights the outcome following the field survey of the subject site and surround.

2.2.2 Threatened populations or critical habitat

No listed threatened populations or critical habitat are recorded in the LGA for any particular species, several species with very limited ranges are present in the Kiama LGA, which are discussed further in section 4.2.

2.2.3 Threatened Species

Literature and database reviews focusing on habitat requirements of threatened species that have been recorded in the locality were scrutinised to filter the 108 threatened and migratory species that have been previously recorded within the locality (Figures 6 and 7 in Appendix B) . The potential for suitable habitat within the subject site and surrounds was then assessed and ground truthed during the field survey in September 2011. The assessment steps included:

- whether the threatened species or population was known or likely to be present in the area from past records, vegetation mapping, recent literature citing experts and the authors knowledge of species' requirements and potential presence;
- the geology of the subject site and surrounds, including the soils and soil profile; drainage; slope and vegetative cover;
- whether suitable broad habitat or resources for the species are present on the subject site or in the locality (e.g. open water bodies, wetlands, rainforest);
- whether the subject site is likely to represent part or all of known or movement corridor for the species; and

- whether other potential habitats are recorded nearby the study area, and therefore would the subject site represent a part of the range of any species as secondary, transient or migratory habitat.

Details on the habitat preferences of all potentially occurring threatened species were examined before the 2011 field surveys were conducted to best target all techniques to indentify occurrence, or potential occurrence and examine relative distribution and abundance across the subject site and in specific similar areas outside the study area. The detailed re-assessments are given in Table 11 and 12 (Appendix B). The likelihood of the presence of any threatened species was reassessed following the field surveys of the subject site and surround.

2.3 Field Surveys

Surveys for flora and fauna have been conducted across the subject site previously in 2005 by BES in and reinvestigated for the current assessment in September 2011.

The extent of survey effort and techniques used throughout this period were conducted to discover the suite of flora and fauna species that utilise the subject site throughout the year, with specific targeted surveys for potentially occurring threatened species, and were conducted with reference to *Threatened Biodiversity Survey and Assessment: Guidelines for Developments and Activities* - working draft (DECC 2004).

2.3.1 Survey effort and technique

Field surveys were initially conducted across the subject site for all species, populations and ecological communities in 2005 by Bushfire Environmental Services Pty Ltd. The BES surveys were conducted on 7 March 2005. The BES surveys and assessments were undertaken in accordance with the *Draft Threatened Species Biodiversity Survey Guidelines for Developments and Activities* (DEC 2004), including the use of survey documentation formats.

To build previous assessment and to identify possible transient species the OMVI Ecological surveys were conducted during Spring on 14th September 2011. The OMVI Ecological surveys conducted this year targeted specifically those subject species included as potentially occurring the original BES report, and any other species of conservation significance potentially occurring in the locality.

Flora

The flora surveys were initially conducted by BES (BES 2005) and updated and documented by OMVI in 2011. The boundaries were walked and delineated using a GPS based on the boundaries. A hand held GPS was used to map the vegetation community boundaries derived by BES in 2005. A complete traverse of the site was used to assist in delineating the all boundaries, which was largely defined by the presence of diagnostic canopy species, diversity of the ground layer and density of the shrub layer.

Incidental observations of flora and fauna were also recorded whilst on site and information provided by local residents has also been included where relevant. This data has been provided in Appendix A.

Community Identification and Floristic Audit

Detailed botanical surveys were conducted by BES in the study area, on 7 March 2005, in the locations shown in Figure 3. Verification of the community boundaries and additional complimentary floristic surveys were undertaken by OMVI Ecological on 23 September 2011.

Initially a random meander technique documented by Cropper (1993) was used across the subject site in general, to document the flora species present, including those of conservation significance, and the location and extent of vegetation communities.

The vegetation was surveyed at all levels present: the canopy (trees), middle canopy (trees), understorey (shrubs), and groundcover plants (plants less than one metre in height). Dominant species and the projected foliage cover of each stratum were recorded at numerous locations that typified the vegetation communities present in the study area. A general description of the vegetation was then prepared based on structural characteristics and dominant canopy species in accordance with Walker and Hopkins (1990) and Specht (1970). These techniques were used to classify and name the vegetation communities in the study area.

The 2011 surveys used a hand-held GPS to confirm the vegetation community boundaries, the location of threatened species and any other items of interest such as habitat trees, cleared areas, and weed infestations.

Digital mapping boundaries of vegetation communities were marked using a combination of GPS field data, aerial photography, landscape position, geology, soils and existing vegetation maps using the ArcGIS 10 software package. The vegetation communities recorded in the subject site were compared with the Final Determinations of the NSW Scientific Committee to ascertain whether the communities were components of listed threatened ecological communities.

Description of the vegetation communities was based on their structure and dominant canopy species, (Tozer *et al* 2006) for comparison with final determination advice on Endangered Ecological Communities (TSC Act and EPBC Act).

Quadrat Surveys

Quantitative data on species richness were collected from 20 x 20 metre quadrats (400m2) replicated across each vegetation association. Two (2) Quadrats were undertaken by BES botanists in 2005 and an additional four (4) quadrats were undertaken by OMVI Ecological in 2011. Quadrat data was used to determine the floristic composition and structure of vegetation associations, and the ecological condition of the vegetation including disturbances and weed abundance. Data noted in each sample plot included:

- dominant species in each structural layer;
- heights of structural layers (i.e. canopy, sub-canopy, shrub and groundcovers);
- a cover abundance score of each layer (based on a modified Braun Blanquet cover scale);
- landscape features (i.e. slope, gully, aspect etc);
- soil features (soil type, rocks, organic matter etc);
- geographical coordinates;
- species richness and abundance;
- an inventory of all species in the plot;

- the presence and abundance of weed species;
- the condition of the vegetation including past and present disturbances such as fire, grazing, logging, etc; and
- the presence, abundance and geographic coordinates of rare and threatened plants species.

The number of quadrats sampled was proportional to the size of the stratification unit and the degree of variation in the stratification unit resulting in a total of six (6) quadrats sampled (Table 1).

Table 1: Flora quadrat effort per habitat stratification unit

VEGETATION TYPE	AREA (HA)	QUADRAT
Illawarra Subtropical Rainforest	0.5	3
Open introduced Grassland	8.0	2
Residential Gardens and introduced Riparian Forest	>0.5	1

Targeted Searches

Specific searches for plant species of conservation significance known from the locality were conducted, using the Random Meander method (Cropper 1993), across all potential habitat for the given targeted taxon. Large distinctive species were targeted using the meandering transect technique, where specific habitats could be targeted for those species.

Limitations

The floristic audit undertaken detected as many species as possible and provides a comprehensive but not definitive species list. More species would probably be detected during a longer survey over various or multiple seasons.

Nevertheless, the techniques used in this investigation are considered adequate to gather the data necessary to identify potential ecological constraints to the future development of the study area.

Nomenclature

Most of the plant species named in this report are the current names published in the Flora of NSW (Harden 1990-1993). The taxonomic names have been supplemented with common names obtained from various sources. The scientific and conservation significance of individual plant species was established with reference to Briggs and Leigh (1996) and the NSW Threatened Species Conservation Act 1995 and Commonwealth Environment Protection and Biodiversity Conservation Act 1999.

The Illawarra Socketwood has had a recent name change to *Daphnandra johnsonii,* where previously and on the schedules of the legislation it is *known as a D*. sp. C *Illawarra.*

Figure 3: Flora surveys effort across the study area

2.3.2 Fauna

Details of specific survey techniques and survey effort for target species are provided below and summarised in Table 13.

Herpetofauna

General herpetofauna surveys involved traversing the subject site and surrounds, examining the habitats present for herpetofauna, turning rocks, logs and other debris as well as spotlighting surveys for nocturnally active species such as frogs and geckos. The aims of the survey were to identify potential habitat for threatened herpetofauna species that might occur in the locality. Potentially occurring herpetofauna targeted for the habitat examination included target species identified by BES (2005) and the Atlas of Wildlife. These included: Rosenberg's Goanna, Broadheaded Snake, and several frog species: Giant Burrowing Frog, Red-crowned Toadlet, Green and Golden Bell Frog, Littlejohn's Tree Frog, and the Stuttering Frog.

Survey techniques employed targeted all frog and reptile species potentially occurring within the study area, and included:

- diurnal searches for sheltering or basking frogs and reptiles;
- rock, log and debris rolling;
- listening for frog calls diurnally and nocturnally;
- active shelter searches; and
- nocturnal spotlighting.

Aquatic Field Surveys

Aquatic habitat surveys were conducted in the subject site along all visible drainage lines or dams with the potential to be affected by the proposed development. Prior to the field investigations a search of the Atlas of Wildlife and detailed literature review of the fish of the Minnamurra River catchment was conducted to determine threatened fish species previously recorded. Waterbodies were surveyed to determine the likelihood of any threatened fish or freshwater aquatic invertebrate species being present, involving general habitat assessments. The habitat survey also determined whether any key threatening processes, as described in the Fisheries Management Act 1994, have the potential to occur or be exacerbated as part of the residential development.

Limitations of the Aquatic Assessment

Surveys of freshwater aquatic habitats were rapid and concentrated on visual habitat assessment and were aimed at identifying suitable habitat for threatened fish and macroinvertebrates species within the study area.

Avifauna

Diurnal Birds

Standardised 60 minute surveys involved traversing the study area, including areas nearby the subject site on foot, and stopping at various points along the traverse for five to ten minutes to identify particular species. Water and wading bird species were targeted at any water body encountered. Birds were identified by observation with binoculars in accordance with Pizzey and Knight (1997) and/or call identification.

Diurnal bird surveys also included searches for habitat features of relevance for particular threatened species. This included searching for evidence of feeding, such as cracked seed, cones, nuts from Gang-gang Cockatoos, chewed She-oak cones from the Glossy-black Cockatoo and Swift Parrot and signs of bird presence, such as pellets, whitewash, nests etc.

Nocturnal birds

Call playback surveys were conducted for the Bush-stone Curlew (*Burhinus grallarius*) Powerful Owl (*Ninox strenua*), Barking Owl (*Ninox connivens*), Masked Owl (*Tyto novaehollandiae*) and Sooty Owl (*Tyto tenebricosa*) over one night in March 2005 (BES 2005).

Mammalian Fauna

Microchiropteran bat surveys

ANABAT echolocation recording was used to target microchiropteran bats in the study area in 2005. One ANABAT II bat detector linked to a Sony Walkman cassette recorder was used along walking transects to record microchiropteran bat echolocation calls. The detector was employed from just before dusk to 1.25 hours after dusk when microchiropteran bat activity is considered to be high. Echolocation calls recorded were sent to a specialist, Mr. Adam Fawcett Regional Ecologist State Forests of NSW, for analysis. *Roost Habitat Identification*

Incidental records of potential roost and foraging habitat for threatened bat species was also recorded. This was based on the presence of hollow bearing trees and caves/overhangs or indirect evidence of bat presence, such as guano, recorded during the regular surveys.

Arboreal Mammals

The 2005 surveys involved walking along a number transects throughout the study area, targeting a range of habitats. 100W hand-held spotlight (powered by a 12 battery) were used to illuminate mammals, birds, reptiles and amphibians (BES 2005).

Diurnal Mammals

During surveys of the subject site in 2005 and 2011, diurnal mammal searches were conducted in areas of potential habitat across the study area, with emphasis on searches for scats, tracks, burrows, diggings, scratching or pads (BES 2005, current surveys).

Specific searches were conducted for habitats or resources of relevance for those threatened fauna species known from the general region, or species, which might be anticipated to occur given the vegetation communities and habitats present. Opportunistic records of all fauna species observed were maintained throughout the survey period, and an inventory was compiled of all species recorded during the current investigations.

Habitat assessments and surveys for fauna signs

Habitat assessments were carried out in the form of diurnal transects undertaken throughout the subject site to identify potential habitats and specific resources for fauna and particularly for threatened species. Walked transects were conducted across the entire area to assess the potential fauna habitat attributes. Additional surveys were aimed at searching for signs of a number of fauna groups and habitat features that could be targeted during diurnal and nocturnal transects.

Transects included searching for:

- trees with bird nests or other potential fauna roosts;
- burrows, dens and warrens;
- ground or arboreal termitaria;
- sap-feeding notches on trees;
- distinctive scats or latrine sites (of particular relevance for the Tiger Quoll), white wash and regurgitated pellets under roost sites, tracks or animal remains;
- evidence of activity such as scratches and diggings;
- stags and tree-hollows that provide potential roost sites for bats, owls, and other hollow-dependant species; and
- caves or similar constructed features (e.g. storm drains) that provide potential roost sites for microchiropteran bats.

Opportunistic Diurnal Surveys

Opportunistic fauna surveys involved observations of animal activity, habitat surveys and searches for indirect evidence of fauna. Diurnal mammal searches were conducted in areas of potential habitat across the study area, with emphasis on searches for scats, tracks, burrows, diggings and scratching. Specific bird, reptile and amphibian searches were conducted across the subject site involving both visual and aural detection of species. Searches for feeding evidence were also conducted for various bird species, including the Glossy Black-cockatoo.

Scats, owl pellets and other remains found on site during the 2011 surveys were analysed by Brendan Ryan.

Hollow-bearing tree surveys

HBT's were inspected for viable hollows using a pair of 10x50mm binoculars. Recently fallen limbs and branches were also inspected to obtain further information on the viability of hollows. All dead and alive HBT's observed were recorded where they met the following criteria:

- Hollow entrance visible
- Hollow appears to have depth
- Hollow appears to be at least 1 metre above the ground.

2.3.3 Limitations

While the results of the studies conducted across the subject site will not likely record all species that transiently or periodically occupy the area, the surveys employed in 2005 and 2011 will have recorded a majority of those species which occupy the heavily modified subject site. However, surveys are subject to constraints that determine the amount of time allocated, the methods used and the timing of the work. Thus the results should be viewed in the light of these limitations. The fauna detected in current survey work are a guide to the native fauna present, but are by no means a definitive list of the species occurring in the locality.

2.3.4 Nomenclature

The nomenclature in this report is based on The Field Guide to the Mammals of Australia (Menkhorst and Knight, 2010), Australian Bats (Churchill 2010), Systematics and Taxonomy of Australia Birds

3. Results

3.1 Disturbances

The subject site comprises heavily disturbed land with much of the native vegetation long removed or modified and replaced with grazing pastures. Remnant native vegetation is generally restricted to a discontinuous narrow band along Hyams Creek, however this vegetation is also heavily disturbed and includes many exotic species.

The disturbances observed within the subject site and surrounds during the survey period included:

- clearing and subsequent grazing and pasture improvement ;
- erosion and bank instability along Hyams Creek;
- fencing and other farming infrastructure;
- heavy weed infestation along Hyams Creek including many large Camphor Laurel *Cinnamonum camphora* and Coral Trees *Erythrina x sykesii*;
- garden waste dumping and plantings along fences with adjacent residences; and
- minor rubbish in Hyams Creek and other parts of the study area.

3.2 Flora

Most of the subject site has been significantly disturbed through historical clearing for agriculture. This has reduced vegetative structure, complexity, age and hence habitat values over most of the study area. The majority of the site is now comprised of introduced pasture grasses and weeds and very little native vegetation now occurs.

The subject site supports three heavily modified vegetation communities, Heavily Disturbed Gallery Subtropical Rainforest, Residential Gardens and Exotic Pasture as shown in Figure 4.

The vast majority of the subject site has long been cleared of native vegetation and converted to grazing pastures. An approximately 250 m length of Hyams Creek along the northern boundary of the subject site supports a narrow band of heavily disturbed remnant subtropical rainforest. Elsewhere along Hyams Creek there are occasional clumps of Camphor Laurel (*Cinnamonum camphora*) trees with exotic pastures extending up to the creek channel.

3.3.1 Vegetation communities

Previous vegetation mapping of the study area, (BES 2005) has been examined and the results of the current vegetation community mapping generally support the vegetation community classifications. Updated vegetation mapping for the region has been used with reference to these results and the vegetation type updated with the most recent descriptions for regional vegetation classifications (Tozer *et.al.* 2006). Some modifications to the boundaries of the respective communities have also resulted.

Heavily Disturbed Gallery Subtropical Rainforest

This community occurs along part of Hyams Creek and is confined to the creek channel and the top of the creek banks. The overstorey is dominated by Coral Trees (*Erythrina X skyseii*) and Camphor Laurel to a height of approximately 15-20 m and a foliage projective cover of approximately 70%. Other canopy species include one individual of Brush Cherry (*Syzygium australe*). There is a sub-canopy dominated by Large-leaved Privet (*Ligustrum lucidium*) and Cheese Tree (*Glochidion ferdinandi*), but also including species such as Sandpaper Fig (*Ficus coronata*) to a height of 8-10 m with a foliage projective cover of approximately 40%.

The understorey is dominated by weeds such as Large-leaved Privet, Small-leaved Privet (*Ligustrum sinense*), and Lantana (*Lantana camara*) but also includes occasional natives such as Whalebone Tree (*Streblus brunonianus*), Native Rosella (*Hibiscus heterophyllus*), and Tree Violet (*Hymenanthera dentate*) to a height of 6 m with a foliage projective cover of approximately 20%.

The groundcover is dense and is generally dominated by the weed Wandering Tradescantia (*Tradescantia fluminensis*) and Basket Grass (*Oplismenus ameulus*), but includes a range of native and exotic herbs, sedges, climbers and creepers such as Kidney Weed (*Dichondra repens*), Tall Sedge (*Carex appressa*), Weeping Meadow Grass (*Microlaena stipoides*), Paddy's Lucerne (*Sida rhombifolia*), Cobbler's Pegs (*Bidens pilosa*), Necklace Fern (*Asplenium flabellifolium*), Binung (*Christella dentate*), *Blechnum camfieldii,* Water Pepper (*Persicaria hydropiper*), and Cape Ivy (*Delairia odorata*) to a height of 1 m with foliage projective cover of approximately 50%.

Species that were detected only on the northern creek bank (and thus outside of Lot 100) include species associated with subtropical rainforests such as Gum Vine (*Aphanopetalum resinosum*), Red-fruited Olive Plum (*Cassine australis*), Cockspur Flower (*Plectranthus parviflorus*), and Grey Myrtle (*Backhousia myrtifolia*).

Exotic Pasture

This community occurs throughout the vast majority of the study area. The community comprises grassland dominated by the exotic grass Kikuyu (*Pennisetum clandestinum*), with other exotic species such as Paspalum (*Paspalum dilatatum*), Fireweed (*Senecio madagascariensis*), Spear Thistle (*Cirsium vulgare*), Tall Fleabane (*Conyza bonariensis*), Purpletop (*Verbena bonariensis*), clovers (*Trifolium* spp.), and Blackberry (*Rubus fruticosus* complex). There are a couple of Coral Trees and an Exotic Cypress Pine *Cupressus* sp.

Residential Gardens

This community occurs around the residence on Lot 1 and along the borders with the residential properties down the eastern margin or Lot 100 and in some sections of Hyams Creek where the species were a mix of introduced and native similar to that found around the residences.. The gardens were bordered generally by garden edging and mowed lawns. Trees have also been planted in a number of locations in Lot 1 as wind breaks. Most of the trees and shrubs used in the gardens are non-endemics and most would not have occurred at this location prior to European occupation. A list of the species recorded can be found in Appendix A.

3.2.1 Flora Species

The vegetation survey and target surveys identified approximately 209 species (Table 9 in Appendix A). Some of these have only been classified to genera, due to the lack of identifiable characteristics, therefore the number of species encountered may be greater or less than that nominated. One hundred and twenty seven (127) or 61% of these species were introduced and another fourteen (14) native species do not naturally occur and are likely to have been planted.

No threatened flora species have been recorded during any of the targeted or general surveys conducted across the subject site in 2005 or 2011. Eighteen (18) noxious weeds were recorded across the subject site.

Figure 4: Vegetation communities mapped across the subject site

3.3 Fauna

3.3.1 Fauna Habitats

The fauna habitats present in the subject site are limited as a result of the level of past disturbance. The habitats within the subject site are those generally associated with exotic pastures and disturbed creeks flanked by vegetation characterised by exotic grasses, weeds and patches of remnant disturbed subtropical rainforest.

The subject site contains foraging resources in the form of:

- a few flowering trees;
- a moderate number of fleshy fruit-bearing plants including rainforest trees and weeds;
- open grassland; and
- Hyams Creek

Foraging and shelter resources are generally very limited with the subject site as a result of the level of disturbance throughout much of study area. However the subject site is likely to provide foraging resources, shelter and nesting habitat for a range of common native and exotic fauna associated with pastures with patches of remnant vegetation in the locality.

Only one small trunk hollow was observed in the subject site during the survey period, in a Camphor Laurel within the remnant vegetation along Hyams Creek. Consequently, there is very limited breeding, roosting or denning habitat for hollow dependant fauna. There are also no significant fallen logs that may provide shelter for terrestrial herpetofauna or mammals. The few fleshy fruit bearing plants flowering gums and acacias provide a small amount of foraging habitat that could potentially be utilised by highly mobile threatened fauna such as the Superb Fruit-dove *Ptilinopus superbus,* however there are no winter flowering trees for other threatened species known to forage in the area from during the winter months, such as the Regent Honeyeater *Xanthomyza phrygia* or the Swift Parrot *Lathamus discolor*.

There are only very minor rock habitats within the subject site in association with Hyams Creek. These minor rock habitats provide some shelter for amphibians and reptiles and Hyams Creek provides potential habitat for a range of common amphibians and reptiles associated with creeks such as the Eastern Water Skink (*Eulamprus quoyii*), the Common Eastern Froglet (*Crinea signifiera*) and White-striped Marsh Frog (*Limnodynastes peronii*). Only two common frog species were detected within the subject site during the survey period and an eel (*Anguilla* sp.) and Australian Bass (*Macquaria novemaculeata*) was observed in Hyams Creek dring the 2005 surveys. The absence of dense stream side vegetation limits Hyams Creek as important habitat for threatened water birds such as the Black Bittern *Ixobrychus* flavicollis and the weedy nature of the water way would also limit the suitability for more uncommon frogs or water birds.

The highly modified state of the vegetation within the subject site would be expected to diminish the potential foraging habitat for microchiropteran bats however a number of species were detected during the 2005 surveys (Table 12) including the threatened species the Greater Broad-nosed Bat (*Scotenax rueppellii*) and guano was recorded at the base of a overhanging coral in Hyams Creek most likely evidence of a Large-footed Myotis (*Myotis macropus*) roosting occasionally at this location above the water. It is likely that microchiropteran bats regularly forage along Hyams Creek, however it is unlikely that they would have permanent roost sites or breeding sites, given the paucity of suitable hollows or caves. The open cleared paddocks are likely to represent only minimal foraging habitat for locally occurring microchiropteran bats.

3.3.2 Fauna Species

Targeted fauna surveys, opportunistic observations, and anecdotal evidence obtained during the survey period resulted in the detection of fifty eight (58) vertebrate species across the subject site, comprising eleven (11) introduced species and forty seven (47) native species. Thirteen (13) mammals, forty one (41) birds, two (2) frogs, two (2) reptiles and two (2) fish were detected and these are listed in Table 12.

This poor faunal diversity recorded in the subject site and immediately adjoining lands is likely the result of absence of intact native vegetation and therefore a lack of foraging and roosting habitats.

3.3.3 Fish Species

Potentially several fish species are likely to use the ephemeral creeks in the subject site when they are flowing or hold water. While only two species were observed during the surveys (Table 12). The heavily modified nature of the surrounding landscape, upstream impacts associated with sedimentation, euthrophication, bank instability and heavy weed infestations have resulted in a modified creek habitat which has limited the suitability/occupation for native fish species.

No threatened fish species listed under the Schedules of the FM Act or EPBC Act are likely to occur in the Hyams Creek catchment. Two critically endangered, an additional thirteen endangered and fifteen vulnerable fish species are currently listed pursuant to the EPBC Act. None of the currently listed fish species are considered of relevance to the subject site, on the basis of their known distributions or because of the absence of suitable habitat.

3.3.4 Amphibians

Only two amphibian species were recorded during the survey periods (Table 12). Both species, the Eastern Froglet (*Crinia signifera*), and the Smooth Toadlet (*Uperoleia* laevigata), are thought to be relatively common and widespread being often recorded in a wide variety of habitats throughout eastern NSW, including cleared farmland. .

3.3.5 Reptiles

Two reptile species were recorded in the study area, the Dark-flecked Garden Skink (*Lampropholis delicata*) and the Red-bellied Black Snake (*Pseudechis porphyriacus*).

The Dark-flecked Garden Skink was recorded amongst leaf litter in the residential gardens and along Hyams Creek. Only one snake species, the Red-bellied Black Snake was observed by the creek. This species is known from a range of habitats, often preferring wet areas with an abundance of frogs, (their main prey) and will occur in agricultural areas and on the periphery of built environments (Wilson and Swan, 2003). The reptile diversity is low and is likely to be limited due to past disturbances.

3.3.6 Birds

Similarly, the subject site provides habitat for a low diversity of bird species. A total of 41 species were recorded comprising of only 37 native and 4 introduced species (Table 12). The influence of introduced birds across the subject site was strong and Common Myna (*Acridotheres tristis*) and Starlings (*Sturnus vulgaris*) were common across the subject site including along Hyams Creek. Both species utilise more open environments.

During the current surveys the majority of avian species recorded were found foraging in vegetation along Hymas Creek and relatively common across the region and South-east coastal area and ranges (Table 12). Generic nectivorous species recorded included wattlebirds, honeyeaters, spinebills, miners and parrots. Common insectivorous species included thornbills, fantails and fairy-wrens. Seed-eating parrots such as the Galah, cockatoos and rosellas were also recorded in vegetation along the creek.

Very few wetland or water bird species were recorded during the surveys. Wood Ducks (*Chenonetta jubata*) and Black Ducks (*Anas superciliosa*), were recorded in Hyams Creek and the White-faced Heron (*Egretta novaehollandiae*) and the Cattle Egret (*Ardea ibis*) were recorded foraging on open paddocks of the subject site and grassy yards of neighbouring properties. Hyams Creek are likely to provide only limited transient habitat for most water birds, due to the degraded nature of the fringing vegetation.

3.3.7 Mammals

A total of fourteen (14) mammals were recorded across the subject site during the surveys in 2005 and 2011. Eight (8) were native mammal species, including seven (7) microchiropteran bat species (Table 12). It is anticipated given the level past disturbances, that a few other native mammals species are likely to occur in the study area.

No arboreal mammals were recorded, however, a possum box was installed in the garden of Lot 1 for a resident Common Brushtail Possum (*Trichosurus vulpecula*). The Common Brushtail Possum is known to regularly utilise artificial structures (e.g. buildings) for shelter and the absence of suitable hollows is not critical for this species. Foraging resources for this species are likely to be the planted trees and shrubs of the residential garden and is common and relatively widespread throughout a wide variety of natural, rural and urban areas of south-eastern NSW.

A relatively diverse range (>7) of microchiropteran bat species was recorded in the subject site (Table 2), considering the past clearing of native vegetation. Of these, one species; the Large-footed Myotis (*Myotis macropus*) rely on caves or similar artificial structures (such as mines and culverts) for roosting. The remainder, roost in tree-hollows, amongst foliage or under bark, and most can also be found roosting in the roof-spaces of buildings, where available.

Table 2 Foraging and roosting requirements of microchiropteran bat species (Churchill 2008) recorded in the study area.

COMMON NAME	SCIENTIFIC NAME	ROOSTING HABITAT				
		TREE-HOLLOWS	UNDER BARK	AMONGST VEGETATION	CAVES	ARTIFICIAL STRUCTURES
Large Footed Myotis	*Myotis macropus*			Dense vegetation near/over water	x	Under bridges, mines near water
A Long-eared Bat	*Nyctophilus* sp.	x	x			Buildings
Greater broad-nosed bat	*Scoteanax rueppellii*	x				Roofs of houses
Eastern Broadnosed Bat	*Scotropens orion*	x				Roofs of houses
Large Forest Bat	*Vespadelus darlingtoni*	x				Buildings
Southern Forest Bat	*Vespadelus regulus*	x		x		Roofs of houses
Little Forest Bat	*Vespadelus vulturnus*	x				Roofs of buildings

Shaded rows =- Vulnerable species listed pursuant to the NSW Threatened Species Conservation Act 1995.

All of the microchiropteran bats recorded in the subject site are insectivorous, catching insects on the wing or gleaning them from foliage or in some instances from the ground (Churchill 2008). The Large-footed Myotis captures insects and sometime small fish from the water surface or by racking its long toes through the water from just below the water's surface. Foraging behaviour varies among species and may be concentrated above, below or within the tree canopy, along the edges of vegetation and cleared land, or sometimes over open grassland areas. The relative absence of hollows and caves within the subject site would mean that very few bats would roost within the subject site if only occasionally, as was recorded in Hyams Creek.

A number of additional threatened microchiropteran bat species have been previously recorded in the locality, some of which could also occur in the subject site on occasion (e.g. Eastern Bent-wing Bat, Eastern False Pipistrelle).

One megachiropteran Bat, the Grey-headed Flying Fox, has been previously recorded in the locality (Figure 7). The Grey-headed Flying Fox is listed as a vulnerable species under both the TSC Act and the Commonwealth EPBC Act. This species feeds on a variety of fruiting and flowering plants, including the fruits of native figs and palms and the blossoms of eucalypts, angophoras, tea-trees and banksias. Grey-headed Flying Foxes roost in large camps which are commonly located in vegetation with a dense canopy in gullies in close proximity to water. The flowering eucalypts and other trees along Hyams Creek and within the adjacent properties gardens are likely to provide limited foraging for this species periodically throughout the year. The subject site does not contain a known camp site for this species and there is no evidence to suggest that the site holds habitat even as temporary roost sites for this species.

3.3.8 Introduced Fauna Species in the Project Area and Surrounds

A total of six (6) introduced terrestrial fauna species have been recorded in the subject site and/or surrounds, including the European Red Fox (*Vulpes vulpes*), dogs (*Canius familiaris*), cats (*Felis catus*), rabbits (*Orytolagus cuniculus*). Horses (*Equus caballus*) and cows (*Bos taurus*) are kept on the subject site.

3.3.9 Species Unlikely to Occur

Many of the threatened fauna species recorded in the locality are of no relevance to the study area, given their habits and/or habitat requirements. In this regard the subject site does not contain:

- marine waters of relevance to the marine turtles, cetaceans or whales;
- estuarine or sandy beach habitats of relevance for the Little Tern, Sooty Tern, Lesser Sand Plover, Sooty Oystercatcher, Pied Oystercatcher or Terek Sandpiper;
- extensive, densely-vegetated freshwater wetlands which provide preferred habitat for the Freckled Duck and the Blue-billed Duck; and
- habitat of relevance for oceanic and pelagic bird species (such as the Wandering Albatross).

Figure 5: Threatened and migratory species recorded in the survey area

4. CONSERVATION SIGNIFICANCE

The NSW Threatened Species Conservation Act 1995 (TSC Act) and the Commonwealth Environment Protection and Biodiversity Conservation Act 1999 (EPBC Act) provide for the listing of threatened flora and fauna species. The EPBC Act also provides for the listing of migratory species. The NSW Fisheries Management Act 1994 (FM Act) provides for the listing of threatened aquatic species and marine vegetation.

The EPBC Act Protected Matters Search Tool and NSW OEH Atlas of Wildlife Database were searched on 28 October 2011 and 25 October respectively. The threatened flora and fauna records from the Atlas of wildlife within a 10 kilometre radius of the subject site are shown in figures 6 and 7 and the Protected Matters search results can be view in Appendix D.

4.1 Endangered Populations

The *TSC Act* provides for the listing of endangered populations on Schedule 1, Part 2. There are no endangered populations listed on the schedules of the *TSC Act* found in the Kiama local government area.

4.2 Endangered Ecological Communities

The *TSC Act* and *EPBC Act* provide for the listing of endangered ecological communities. The Heavily Disturbed Gallery Subtropical Rainforest along parts of Hyams Creek comprises a depauperate and disturbed component of the endangered ecological community Illawarra Subtropical Rainforest listed on the *TSC Act*.

Illawarra Subtropical Rainforest in the Sydney Basin Bioregion

Illawarra Subtropical Rainforest is the name given to the ecological community on high nutrient soils in the Illawarra area within the Sydney Basin Bioregion. Illawarra Subtropical Rainforest includes Subtropical Rainforest (Type 1), Moist Subtropical Rainforest (Type 2) and Dry Subtropical Rainforest (Type 3) of Mills, K & Jakeman, J. (1995 *Rainforests of the Illawarra District* (Coachwood Publishing, Jamberoo). (The classification of Mills & Jakeman was developed specifically for the Illawarra - in a broader context much of the community recognised here would fall within dry forest (suballiance 23) in Floyd, A. G. (1990). *Australian rainforests in New South Wales* (Vols 1 and 2, Surrey Beatty and Sons, Chipping Norton). Although rainforest canopies are generally closed, in highly disturbed stands the canopy may be irregular and open. Canopy height varies considerably, and structurally some stands are scrub.

Characteristic tree species in the Illawarra Subtropical Rainforest are *Baloghia inophylla, Brachychiton acerifolius, Dendrocnide excelsa, Diploglottis australis, Ficus* spp., *Pennantia cunninghamii* and *Toona ciliata*. Stands may have species of Eucalyptus, Syncarpia and Acacia as emergents or incorporated into the dense canopy. Illawarra Subtropical Rainforest occurred mainly on the coastal Permian volcanics, but can occur on a range of geological substrates, mainly between Albion Park and Gerringong (termed the Illawarra Brush by Mills and Jakeman 1995) and north of Lake Illawarra on the Berkeley Hills (termed the Berkeley

Brush by Mills & Jakeman 1995). The Illawarra Brush and Berkeley Brush originally covered about 13 600 ha and made up about 60% of the rainforest of the Illawarra area. Outlying occurrences of Illawarra Subtropical Rainforest also occur south to the Shoalhaven River and westwards into Kangaroo Valley, where areas of Permian volcanic soils occur. The community generally occurs on the coastal plain and escarpment foothills, rarely extending onto the upper escarpment slopes.

The vegetation along Hyams Creek includes six of the twenty-nine (or 20%) characteristic species listed in the final determination for the Illawarra Subtropical Rainforest (NSW Scientific Committee 2002). Whilst this is not a particularly high percentage of the species that characterise the community, the remnant vegetation along Hyams Creek is confined to a relatively small area (approximately 0.5 ha) and is highly disturbed. In addition, the remnant vegetation includes species described as characteristic of subtropical rainforest by Mills and Jakeman (1995) such as Figs *Ficus* spp., Red-fruited Olive-plum, Orange Thorn, Gum Vine and Whalebone Tree. Grey Myrtle is also present along Hyams Creek, which is often the case on the margins of subtropical rainforest in drier locations (Mills and Jakeman 1995).

The remnant vegetation along Hyams Creek also includes seven of the twenty-three (or 30%) positive diagnostic species of the Lowland Dry-Subtropical Rainforest of NPWS (2002a). The surveying and analysis undertaken for this report both by BES in 2005 and OMVI in the current assessment suggest that Hyams Creek supports a depauperate and heavily disturbed remnant of a drier form of the Illawarra Subtropical Rainforest. This occurrence may have previously extended further into the subject site but is more likely to have been restricted primarily to the outcrops of the Budgong Sandstone along the Hyams Creek channel. The historical clearing of native vegetation and the restriction of this remnant vegetation to a narrow band along the channel would influencing the and microclimate of the understorey and ground layers.

The impacts on the Illawarra Subtropical Rainforest associated with future residential development of the subject site will be assessed further in a subsequent section of the report.

Table 3: Threatened Communities, populations and critical habitat and their likelihood of occurring within the study area.

THREATENED ECOLOGICAL COMMUNITY	STATUS*	RECORDED IN SURVEY	RECORDED PREVIOUSLY IN LOCALITY	POTENTIAL HABITAT IN STUDY AREA	LIKELIHOOD OF OCCURRING WITHIN STUDY AREA
Coastal Saltmarsh in the NSW North Coast, Sydney Basin and South East Corner Bioregions	E	No	No	No	No
Freshwater Wetlands on Coastal Floodplains of the NSW North Coast, Sydney Basin and South East Corner Bioregion	E	No	Yes	No	No
Bangalay Sand Forest of the Sydney Basin and South East Corner bioregions	E	No	Yes	No	No
Swamp Oak Floodplain Forest of the NSW North Coast, Sydney Basin and South East Corner Bioregions	E	No	Yes	No	No

THREATENED ECOLOGICAL COMMUNITY	STATUS*	RECORDED IN SURVEY	RECORDED PREVIOUSLY IN LOCALITY	POTENTIAL HABITAT IN STUDY AREA	LIKELIHOOD OF OCCURRING WITHIN STUDY AREA
Swamp Sclerophyll Forest on Coastal Floodplains of the NSW North Coast, Sydney Basin and South East Corner Bioregions	E	No	Yes	No	No
River-Flat Eucalypt Forest on Coastal Floodplains of the North Coast, Sydney basin and South East Corner bioregions	E	No	No	No	No
Littoral Rainforest in the NSW North Coast, Sydney Basin and South East Corner bioregions	E, CE1	No	No	No	No
Lowland Rainforest in the NSW North Coast and Sydney Basin Bioregions	E	No	Yes	Yes	Possible
Illawarra Subtropical Rainforest in the Sydney Basin Bioregion	**E**	**Yes**	**Yes**	**Yes**	**Yes**
Milton Ulladulla Subtropical Rainforest in the Sydney Basin Bioregion	E	No	No	No	No
Illawarra Lowlands Grassy Woodland in the Sydney Basin Bioregion	E	No	Yes	No	No
Themeda Grassland on Seacliffs and Coastal Headlands in the NSW North Coast, Sydney Basin and South East Corner Bioregions	E	No	No	No	No
Moist Shale Woodland in the Sydney Basin Bioregion	E	No			
Robertson Rainforest in the Sydney Basin Bioregion	E	No	No	No	No
Southern Highlands Shale Woodlands in the Sydney Basin Bioregion	E	No	Yes	No	No
Melaleuca armillaris Tall Shrubland in the Sydney Basin Bioregion	E	No	Yes	No	No
Robertson Basalt Tall Open-forest in the Sydney Basin Bioregion	E	No	No	No	No
Tablelands Frost Hollow Grassy Woodlands in the South Eastern Highlands, Sydney Basin, South East Corner and NSW South western Slopes Bioregions	E	No	No	No	No
Montane Peatlands and Swamps of the New England Tableland, NSW North Coast, Sydney Basin, South East Corner, South Eastern Highlands and Australian Alps bioregions	E	No	No	No	No

Status
***V** =vulnerable (TSC Act) **V1**= Vulnerable (EPBC Act), **E** = endangered (TSC Act), **E1**= Endangered (EPBC Act), **CE** = critically endangered (TSC Act), **CE1** = critically endangered (EPBC Act).
Likelihood of species occurring within study area:
No (no suitable habitat on site, or surrounding site); **Unlikely** (suitable habitat recorded within subject site yet no records exist within close proximity to the study area**; Likely** (recorded in the locality, suitable habitat recorded within study area); **Yes** (recorded within study area)

4.3 Threatened Flora

No threatened flora species were recorded during the surveys conducted in 2005 or 2011. An assessment of the likelihood of species presence in the subject site is summarised below in Table 4 and detailed in Table 12, Appendix B. The subject site provides a small amount of marginal habitat for a number of threatened flora in the remnant disturbed subtropical rainforest along Hyams Creek. However no threatened species were detected within the subject site during the survey period and it is considered unlikely that any occur there. As it is highly unlikely that any threatened flora species occur in the study area, the effects on threatened flora species of the future residential development of the study area, will not be assessed further in this report.

Table 4: Threatened flora and their likelihood of occurring within the study area, following detailed surveys

SPECIES	STATUS *	RECORDED IN SURVEY	RECORDED PREVIOUSLY IN LOCALITY	POTENTIAL HABITAT IN STUDY AREA	LIKELIHOOD OF SPECIES OCCURRING WITHIN STUDY AREA
Bynoe's Wattle *Acacia bynoeana*	E, V1	NO	NO	NO	UNLIKELY
Downy Watlle *Acacia pubescens*	V, V1	NO	NO	NO	NO
Sunshine Wattle *Acacia terminalis ssp terminalis*	E, E1	NO	NO	NO	NO
Deane's Boronia *Boronia deanei*	V, V1	NO	YES	NO	NO
Thick Lip Spider Orchid *Caladenia tessellata*	E, V1	NO	NO	NO	NO
Leafless Tongue Orchid *Cryptostylis hunteriana*	V, V1	NO	NO	NO	NO
White-flowering Wax Plant *Cynanchum elegans*	E. E1	NO	YES	YES	**POSSIBLE**
Illawarra Socketwood *Daphnandra johnsonii* (syn D.sp. C *Illawarra)*	V	NO	YES	YES	**POSSIBLE**
Albatross Mallee *Eucalyptus langleyi*	V, V1	NO	NO	NO	No
Ettrema Mallee *Eucalyptus sturgissiana*	E	NO	NO	NO	UNLIKELY
Brittle Midge Orchid *Genoplesium baueri*	V	NO	NO	NO	UNLIKELY
Large Midge Orchid *Genoplesium superbum*	E	NO	NO	NO	NO
Grevillea parviflora subsp. parviflora	V, V1	NO	YES	NO	UNLIKELY
Illawarra Irene Irenepharsus trypherus	E, E1	NO	YES	YES	**POSSIBLE**
Biconvex Paperbark *Melaleuca bioconvexa*	V, V1	NO	NO	NO	NO
Deane's Paperbark *Melaleuca deanei*	V, V1	NO	NO	NO	NO
Spiked Rice-flower	E, E1	NO	YES	NO	NO

SPECIES	STATUS *	RECORDED IN SURVEY	RECORDED PREVIOUSLY IN LOCALITY	POTENTIAL HABITAT IN STUDY AREA	LIKELIHOOD OF SPECIES OCCURRING WITHIN STUDY AREA
Pimelea spicata					
Illawarra Greenhood *Pterostylis gibbosa*	E, E1	NO	YES	NO	**Unlikely**
Waterfall or Pretty Orchid *Pterostylis pulchella*	V, V1	NO	YES	NO	NO
Magenta Lily Pily Syzygium paniculatum	E, V1	NO	YES	YES	**POSSIBLE**
Solanum celatum	E	NO	YES	YES	**POSSIBLE**
Kangaloon Sun-orchid *Thelymitra* sp. Kangaloon (D.L.Jones 18108)	CE	NO	NO	NO	NO
Austral Toad-flax *Thesium australe*	V, V1	NO	NO	NO	UNLIKELY
Illawarra Zieria *Zieria granulata*	E, E1	NO	YES	YES	**POSSIBLE**
Warty Zieria *Zieria tuberculata*	V, V1	NO	YES	NO	NO

Status
***V** =vulnerable (TSC Act) **V1**= Vulnerable (EPBC Act), **E** = endangered (TSC Act), **E1**= Endangered (EPBC Act), **CE** = critically endangered (TSC Act), **CE1** = critically endangered (EPBC Act).
Likelihood of species occurring within study area:
No (no suitable habitat on site, or surrounding site); **Unlikely** (suitable habitat recorded within subject site yet no records exist within close proximity to the subject site with**;** **Possible** (recorded in the locality, suitable habitat recorded within study area); **Yes** (recorded within study area)

4.3.1 Threatened Species Possibly Occurring

White-flowering Wax Plant

The White-flowering Wax plant (*Cynanchum elegans*) is a climber or twiner with a highly variable form. It is a clonal species with underground suckering stems and is rarely stoloniferous. Mature stems have a fissured corky bark and can grow to 10 m high and 3.5 cm thick. Leaves are opposite, rarely in whorls of three, broadly ovate to ovate, 1.5 to 15 cm long, 1.5 to 7.5 cm wide and exude a milky sap when damaged. Juvenile leaves are lanceolate to narrow lanceolate. Flowers are white, tubular, up to 4mm long, 6 to 12 mm wide and occur in cymo-umbels, few flowered clusters or umbels on branched peduncles. Flowering occurs primarily between August and May, with the peak in November (NPWS 1993).

Cynanchum elegans grows in rainforest gullies, scrub & scree slopes usually occurs on the edge of dry rainforest or littoral rainforest, but also occurs in Coastal Banksia Scrub, open forest and woodland, and Melaleuca scrub (DEC 2007). The known geographic range of the species extends from Yabbra State Forest (north-east of Tenterfield) in the north to Gerroa in the south and west to Merriwa in the Upper Hunter.

Targeted surveys for threatened species conducted across the subject site in 2005 and 2011 did not record this species. There are several records of *C. elegans* in the locality. The closest record is approximately 3.5 km to the north of the Minnamurra River (Figure 6). A readily

identifiable plant, particularly in the open degraded potential habitat of the subject site suggest that *C. elegans* is unlikely to be present in the study area. On this basis, it is not 'likely' that the proposed re-zoning for a residential sub-division will result in 'a significant effect' on the *C. elegans.*

Illawarra Socketwood

The Illawarra Socketwood (*Daphnandra johnsonii*) (syn D. sp. C Illawarra) is a medium sized rainforest tree belonging to the Monimiaceae family. The species is endemic to the Illawarra region of NSW where it is recorded from 41 sites in the local government areas of Wollongong, Shellharbour, Kiama and Shoalhaven. The species is highly clonal and as a consequence, its total population size is expected to be low. Some sites are suspected of containing just one genetic individual.

Daphnandra johnsonii inhabits the rainforests of the coastal lowlands, rarely extending onto the upper escarpment slopes. These rainforests have been extensively cleared since European settlement and remaining habitat for the species is limited and highly fragmented. The main threat to the survival of the species is further clearing for agriculture, hard rock quarrying, residential development and road construction. Other threats include weed invasion, altered hydrological conditions, grazing and trampling by livestock and feral deer, and rubbish dumping

Associated vegetation includes the subtropical, moist subtropical, dry subtropical and mixed subtropical - warm temperate rainforest types of Mills & Jakeman (1995).

D. johnsonii has been recorded from 36 sites on freehold land and three sites within Budderoo National across its current known distribution of *D. johnsonii* between Avondale in the Wollongong LGA to Toolijooa in the Kiama LGA. An outlying site at Scarborough (northern Wollongong LGA) is located approximately 35 kilometres north of this main distribution. The species' western distributional limit follows the upper slopes of the Illawarra escarpment.

Targeted surveys for threatened species conducted across the subject site in 2005 and 2011 did not record this species. There are numerous records of *D. johnsonii* in the locality (Figure 6) where all are associated with rainforest slopes many south facing. Habitat available within the subject site is heavily degraded and weedy patch along the northern boundary. The absence of the species during targeted surveys and the limited degraded habitat present it is highly unlikely that this species would not be detected if present. It is therefore unlikely to be present in the study area. On this basis, it is not 'likely' that the proposed rezoning for a residential sub-division will result in 'a significant effect' on the *D. johnsonii.*

Illawarra Irene

The Illawarra Irene (*Irenepharsus. trypherus*) is a glabrous (shiny) annual or short lived perennial herb with a spreading to erect habit and is often multi-stemmed, with stems growing to 250 cm. Occupying steep rocky slopes and cliff lines at the ecotone of sclerophyll forest and rainforest. It is known historically from 17 sites in the Illawarra and Shoalhaven regions of NSW. Ten of these sites are located on freehold land while seven sites are located within conservation reserves.

The main distributional range of *I. trypherus* extends from Marshall Mount (Wollongong LGA) to Lake Yarrunga in Morton National Park (Wingecarribee LGA). Sites within this range of approximately 41 kilometres are largely confined to the upper slope of the ridge systems that extend south and east from the Illawarra escarpment (ie Stockyard Mountain, Marshall Mount, Johnston's Ridge and Hindmarsh Ridge). One site has been recorded outside this range at Ettrema Gorge in Morton National Park, approximately 29 kilometres south of Lake Yarrunga.

Vegetation associations for *I. trypherus* include: *E. piperita* (Sydney Peppermint) – *E. saligna* X *botryoides* open forest and *Backhousia myrtifolia* low open to closed forest. Other vegetation associations include Subtropical rainforest and Mixed subtropical – warm temperate rainforest.

Targeted surveys for threatened species conducted across the subject site in 2005 and 2011 did not record this species. There are several records to the west on the escarpment and ranges with half in Budderoo National Park (Figure 6). The absence of the species during targeted surveys and limited potential habitat in the subject site and absence of records in the immediate area suggest that *I. trypherus* is unlikely to be present in the study area. On this basis, it is not 'likely' that the proposed rezoning for a residential sub-division will result in 'a significant effect' on *I. trypherus.*

Magenta Lilly Pilly

The Magenta Lilly Pilly (*Syzygium paniculatum*) is a small to medium sized rainforest tree, which grows from 3-8m high. The bark is flaky and leaves are lanceolate to obovate, 4.5-10cm long. Leaves are generally dark green and glabrous (shiny) on the upper surface and paler underneath. Plants have white inflorescences that form at the end of each branch, and it is this feature from which the species derives its name (i.e. paniculate). The fruit are a spherical to ovoid berry, deep magenta in colour, and contain a single seed.

S. paniculatum is a widely cultivated species available as an ornamental and garden plant but is endemic to NSW. Occurring on the South Coast, Central Coast and North Coast in the Great Lakes, Dungog, Lake Macquarie, Wyong, Gosford, Canterbury, Sutherland and Shoalhaven LGAs. The south coast populations of the species are a disjunct occurrence, with no records between Towra Point and Jervis Bay (Mills 1996).

At Jervis Bay on the south coast of NSW, *S. paniculatum* occurs on sandy grey soils over sandstone, restricted mainly to remnant stands of littoral rainforest. Mills (1993) described this community as composed mainly of the following tree species: *S. paniculatum, Ficus obliqua, Glochidion ferdinandi, Endiandra sieberi, Synoum glandulosum, Podocarpus elatus, Cassine australis, Notelaea longifolia, Guioa semiglauca, Acmena smithii* and *Pittosporum undulatum*.

Targeted surveys for threatened species, conducted across the subject site in 2005 and 2011, did not record this species. There is no records of *S. paniculatum* within 10km of the study area (Figure 6). The absence of the species during targeted surveys and lack of suitable habitat suggest that *S. paniculatum* is unlikely to be present in the study area. On this basis, it is not 'likely' that the proposed rezoning for a residential sub-division will result in 'a significant effect' on the *S. paniculatum.*

Solanum celatum

A small shrub growing in rainforest clearings, and wet sclerophyll forest. *S. celatum* is endemic to New South Wales and has been recorded from a restricted area from Wollongong to just south of Nowra, and west to Bungonia. *S. celatum* is a fire sensitive obligate seeder. The majority of records are prior to 1960 and a recent survey of six sites found only a single plant within Macquarie Pass National Park, SW of Wollongong.

Targeted surveys for threatened species conducted across the subject site in 2005 and 2011 did not record this species. There are seven records of *S. celatum* and two are post 1980 (Figure 6) in rainforest or moist wet forest. The absence of the species during targeted surveys of the small area disturbed potential habitat suggest that *S. celatum* is unlikely to be present in the study area. On this basis, it is not 'likely' that the proposed rezoning for a residential sub-division will result in 'a significant effect' on the *S. celatum.*

Illawarra Zieria

The Illawarra Zieria is a tall bushy shrub that grows to 6 m. The entire plant is densely covered with glandular tubercles (small wart-like outgrowths) that give a strong aroma when crushed. Restricted to the Illawarra region where it is recorded from a number of sites. The species primarily occupies the coastal lowlands between Oak Flats and Toolijooa, in the local government areas of Shellharbour and Kiama. This is a range of approximately 22 kilometres. Flowering occurs between early spring and summer. The Illawarra Zieria has been observed to coppice from damaged stems in response to physical disturbance including grazing and slashing. Seed dispersal is initially through forcible ejection from the mature fruit, and it is suspected that secondary dispersal by ants also occurs. Mass germination of seeds has been observed following soil disturbance.

There numerous records of the Illawarra Zieria across the locality and one record from only 250 metres to the west of the subject site (Figure 6). Despite this and the presence of potential habitat surveys for this species conducted across the subject site in 2005 and 2011 did not record the Illawarra Zieria. The absence of the species during targeted surveys of the small area disturbed potential habitat suggest that the Illawarra Zieria is unlikely to be present in the study area. On this basis, it is not 'likely' that the proposed rezoning for a residential sub-division will result in 'a significant effect' on the Illawarra Zieria.

4.3.2 Other species unlikely to occur

There is a range of other threatened species that rely on conditions not present in the subject site such as coastal saltmarsh, large open water and sedge lands, hanging swamps or wetlands or woodlands. These species are considered highly unlikely to occur due the complete absence of suitable habitat.

4.3.3 Noxious Weeds

Five noxious weeds listed under the NW Act for Kiama LGAs occurred within the subject site (Table . Three of these species; Willows (*Salix* spp.), Bridal Veil Creeper (*Ageratina adenophora)* and Blackberry (*Rubus fruticosus*) are listed on a state wide basis. Lantana and

Blackberry are also listed as Weeds of National Significance in Australia. The *Noxious Weeds Act 1993* requires that noxious weeds must be controlled using techniques specified by NSW Agriculture. On private land the responsibility lies with the occupier of the land.

Willows and Bridal Veil Creeper are listed as Class 5 Noxious Weed under the NW Act. Class 5 noxious weeds are plants that are likely, by their sale, the sale of their seeds, or movement within the State or an area of the State, to spread in the State or outside the State. Willows were recorded in dense infestations along Hyams Creek. The NW Act specifies that Class 5 Noxious Weeds must not be sold or purchased and must not be removed from the land.

Lantana and Blackberry and Bridal Veil Creeper (in Kiama LGA) are listed as a Class 4 Noxious Weed under the NW Act. Class 4 noxious are plants that threaten the primary production, the environment or human health, are widely distributed in an area to which the order applies and are likely to spread in the area or to another area. Blackberry and Bridal Veil Creeper were recorded in low density within the Hyams Creek Riparian area. Lantana was recorded in dense thickets along Hyams Creek.

The growth and spread of Class 4 noxious weeds must be controlled according to the measures specified in a management plan published by the local control authority. In accordance with the Local Weed Control Plans, Blackberry, Lantana and Bridal Veil Creeper plants must be prevented from spreading and growing by treating all plants prior to flowering or seeding, and the plant must be prevented from growing within 15 metres of a property boundary or watercourse.

Table 5: Noxious weeds recorded across the subject site

FAMILY	BOTANICAL NAME	COMMON NAME	NV Act Status
ASPARAGACEAE	*Asparagus asparagoides**	Bridal Veil Creeper	C4 / C5(S)
POACEAE	*Sporobolus fertilis**	Giant Parramatta Grass	C3
ROSACEAE	*Rubus fruticosus* (sp. agg.)*	Blackberry	C4 (S)
SALICACEAE	*Salix sp**	Willows	C5(S)
VERBENACEAE	*Lantana camara**	Lantana	C4

Key
C1 = Class 1 - State Prohibited Weed. Class 1 weeds are also notifiable weeds
C2 = Class 2 - Regionally Prohibited Weed. Class 2 weeds are also notifiable weeds
C3 = Class 3 - Regionally Controlled Weed.
C4 = Class 4 - Locally Controlled Weed.
C5 = Class 5 - Restricted Weed. Class 5 weeds are also notifiable weeds.
(S) = The weed is declared statewide.

State/Regional Declarations
Weeds are declared on a Local Control Authority (LCA) basis and declarations for the same noxious weed can vary across the State. There are 128 LCAs.

4.4 Fauna

Of the sixty four (64) threatened species recorded in the locality only two (2) were recorded in the subject site or surrounds, an additional twelve (12) have the potential to occur if only transiently, and 50 are unlikely to occur due to the absence of recent local records, absence of suitable habitat or that the species is thought to be possibly extinct in the locality or region.

Table 6 below summarises the likelihood of occurrence, with more detail given in Table 12 in Appendix B.

4.4.1 Threatened populations or critical habitat

No listed threatened populations or critical habitat for any faunal species are recorded in the locality or region on either the NSW TSC Act, or FM Act or federal EPBC Act.

Table 6: Threatened fauna and their likelihood of occurring within the study area, following detailed surveys

SPECIES	STATUS*	RECORDED IN SURVEY	RECORDED PREVIOUSLY IN LOCALITY	POTENTIAL HABITAT IN STUDY AREA	LIKELIHOOD OF SPECIES OCCURRING WITHIN STUDY AREA
Fish					
Australian Grayling *Prototroctes maraena*	E, V1	NO	YES	NO	UNLIKLEY
Macquarie Perch *Macquaria australasica*	E, E1	NO	YES	NO	NO
Amphibians					
Giant Burrowing Frog *Heleioporus australiacus*	V, V1	NO	YES	NO	NO
Red-crowned Toadlet *Pseudophryne australis*	V	NO	NO	NO	NO
Green and Golden Bell Frog *Litoria aurea*	E, V1	NO	YES	NO	NO
Littlejohn's Tree Frog *Litoria littlejohni*	V, V1	NO	YES	NO	NO
Stuttering Frog *Mixophyes balbus*	E, V1	NO	YES	NO	NO
Reptiles					
Green Turtle	V, V1	NO	YES	NO	NO
Broad-headed Snake (*Hoplocephalus bungaroides*)	E, V1	NO	NO	NO	NO
Rosenberg's Goanna *Varanus rosenbergi*	V	NO	NO	NO	No
Avifauna					
Freckled Duck *Stictonetta naevosa*	V	NO	YES	NO	NO
Blue-billed Duck *Oxyura australis*	V	NO	NO	NO	NO
Wandering Albatross *Diomedea exulans*	E, V1	NO	YES	NO	NO
Black-necked Stork *Ephippiorhynchus asiaticus*	E	NO	YES	NO	NO
Black Bittern *Ixobrychus flavicollis*	V	NO	YES	NO	Unlikely
Australasian Bittern *Botaurus poiciloptilus*	V	NO	YES	NO	NO
Square-tailed Kite *Lophoictinia isura*	V	NO	YES	YES	**POSSIBLE**
Osprey *Pandion haliaetus*	V	NO	NO	YES	UNLIKLEY
Little Eagle *Hieraaetus morphnoides*	V	NO	YES	YES	**POSSIBLE**
Spotted Harrier *Circus assimilis*	V	NO	YES	YES	**POSSIBLE**
Bush Stone-curlew *Burhinus grallarius*	E	NO	YES	NO	UNLIKLEY
Comb-crested Jacana *Irediparra gallinacea*	V	NO	YES		NO

SPECIES	STATUS*	RECORDED IN SURVEY	RECORDED PREVIOUSLY IN LOCALITY	POTENTIAL HABITAT IN STUDY AREA	LIKELIHOOD OF SPECIES OCCURRING WITHIN STUDY AREA
Australian Painted Snipe *Rostralula australis*	V	NO	NO	NO	UNLIKLEY
Hooded Plover *Thinornis rubicollis*	CE, V1	NO	NO	NO	NO
Superb Fruit Dove *Ptilinopus superbus*	V	NO	YES	YES - limited	**POSSIBLE**
Glossy Black-Cockatoo *Calyptorhynchus lathami*	V	NO	YES	NO	NO
Gang-gang Cockatoo *Callocephalon fimbriatum*	V	NO	YES	NO	NO
Little Lorikeet *Glossopsitta pusilla*	V	NO	YES	YES	**POSSIBLE**
Swift Parrot *Lathamus discolor*	E, E1	NO	NO	YES	UNLIKELY
Orange-bellied Parrot *Neophema chrysogaster*	CE, CE1	NO	NO	NO	NO
Turquoise Parrot *Neophema pulchella*	V	NO	YES	NO	UNLIKLEY
Eastern Ground Parrot *Pezoporus wallicus*	V	NO	YES	NO	NO
Powerful Owl *Ninox strenua*	V	NO	YES	NO	UNLIKLEY
Barking Owl *Ninox connivens*	V	NO	YES	NO	UNLIKLEY
Sooty Owl *Tyto tenebricosa*	V	NO	YES	NO	UNLIKLEY
Masked Owl *Tyto novaehollandiae*	V	NO	NO	NO	UNLIKLEY
Eastern Bristlebird *Dasyornis brachypterus*	E, V1	NO	YES	NO	NO
Regent Honeyeater *Anthochaera phrygia*	E, E1	NO	NO	NO	NO
White-fronted Chat *Epthianura albifrons*	V	NO	YES	YES -limited	UNLIKLEY
Flame Robin *Petroica phoenicea*)	V	NO	YES	YES -limited	UNLIKLEY
Scarlet Robin *Peterocia boodang*	V	NO	YES	YES -limited	UNLIKLEY
Pink Robin *Petroica rodinogaster*	V	NO	NO	YES -limited	**POSSIBLE**
Varied Sittella *Daphoenositta chrysoptera*	V	NO	YES	YES -limited	UNLIKLEY
Olive Whistler *Pachycephala olivacea*	V	NO	YES	NO	UNLIKELY
Bats					
Grey-headed Flying-fox *Pteropus poliocephalus*	V, V1	NO	YES	YES	**POSSIBLE**
Yellow-bellied Sheathtail-bat *Saccolaimus flaviventris*	V	NO	NO	YES	**POSSIBLE**
East Coast Freetail-bat *Mormopterus norfolkensis*	V	NO	NO	YES	**POSSIBLE**
Large-eared Pied Bat *Chalinolobus dwyeri*	V, V1	NO	YES	YES	**POSSIBLE**
Eastern False Pipistrelle *Falsistrellus tasmaniensis*	V	NO	YES	YES	**POSSIBLE**
Eastern Bentwing-bat *Miniopterus schreibersii oceanensis*	V	NO	YES	YES	**POSSIBLE**
Large-footed Myotis *Myotis marcropus*	V	YES - possible	YES	YES	**YES - possible**
Greater Broad-nosed Bat	V	YES	YES	YES	**YES**

SPECIES	STATUS*	RECORDED IN SURVEY	RECORDED PREVIOUSLY IN LOCALITY	POTENTIAL HABITAT IN STUDY AREA	LIKELIHOOD OF SPECIES OCCURRING WITHIN STUDY AREA
Scoteanax rueppellii					
Other Mammals					
Spotted-tailed Quoll *Dasyurus maculatus*	E, E1	NO	YES	YES -limited	**POSSIBLE**
White-footed Dunnart *Sminthopsis Leucopus*	V	NO	NO	NO	NO
Southern Brown Bandicoot *Isoodon obesulus*	E, E1	NO	NO	NO	NO
Koala *Phascolarctos cinereus*	V	NO	YES	NO	NO
Eastern Pygmy Possum *Cercatetus nanus*	V	NO	YES	NO	NO
Yellow-bellied Glider *Petaurus australis*	V	NO	YES	NO	NO
Squirrel Glider *Petaurus norfolcensis*	V	NO	NO	NO	NO
Long-nosed Potoroo *Potorous tridactlus*	V, V1	NO	YES	NO	NO
Parma Wallaby *Macropus parma*	V	NO	NO	NO	No
Brush-tailed Rock Wallaby *Petrogale penicillata*	E, V1	NO	YES	NO	NO
Smoky Mouse *Pseudomys fumeus*	E, E1	NO	NO	YES	NO
New Holland Mouse *Pseudomys novaehollandiae*	V1	NO	NO	YES	NO

Status
***V** =vulnerable (TSC Act) **V1**= Vulnerable (EPBC Act), **E** = endangered (TSC Act or FM Act), **E1**= Endangered (EPBC Act), **CE** = critically endangered (TSC Act), **CE1** = critically endangered (EPBC Act).
Likelihood of species occurring within study area:
No (no suitable habitat on site, or surrounding site); **Unlikely** (suitable habitat recorded within subject site yet no records exist within close proximity to the subject site with**;** **Likely** (recorded in the locality, suitable habitat recorded within study area); **Yes** (recorded within study area)

Threatened Species recorded in the study area

Only two threatened vertebrate fauna species have been recorded within the subject site or in adjoining habitats during recent fauna investigations (BES 2005, current surveys) (Table 7). Both of these species are listed as vulnerable in NSW under the TSC Act. No species listed as threatened on a national basis under the EPBC Act were recorded.

The habitat requirements of these species and the assessment of potential impacts associated with the any future residential development are detailed below and

Table 6 notes records of occurrence with regard to the study area.

Table 7 Threatened fauna species recorded in the subject site or in adjoining habitats.

SPECIES NAME	STATUS	RECORD
Large-footed Myotis	V	Single definite Anabat recording in 2005. Foraging habitat present along creek. No roosting or breeding habitat recorded in the study area.
Greater Broad-nosed Bat	V	Single possible temporary roost recorded in 2011 from a guano deposit in the creek channel. Foraging and roosting habitat recorded in the along Hyams Creek.
Status *V =vulnerable (TSC Act) V1= Vulnerable (EPBC Act)		

4.4.2 Threatened Species Possibly Occurring

A number of additional threatened fauna species have been previously recorded within a 10 kilometre radius of the subject site [the 'locality'] (Figure 7). Many of these additional species are considered likely to occur in the subject site or may potentially occur (at least on occasion) on the basis of the habitats and resources present (Table 6). Other species, however, are highly unlikely to occur given an absence of suitable habitat (Table 12).

The specific habitat requirements of those threatened fauna species previously recorded in the locality and an assessment of the likelihood of their occurrence in the general subject site is provided below.

Square-tailed Kite

The Square-tailed Kite (*Lopoictinia isura*) is a reddish, medium sized, long-winged raptor and is listed as vulnerable under the TSC Act. The species ranges along coastal and sub-coastal areas from south-western to northern Australia, Queensland, NSW and Victoria. It is a summer breeding migrant in the south-east, including the NSW south Coast, arriving in September and leaving by March. The species is found in a variety of timbered habitats including dry woodlands and open forest (DECC 2009).

L. isura is uncommon, yet widespread across NSW and mainland Australia, but does not occur in the arid treeless central regions (Debus & Czechura, 1989). Seasonal records suggest that it is probably a spring-summer breeding migrant that winters in northern Australia (NPWS, 2000b). Square-tailed Kites feed primarily on birds, their eggs and nestlings and insects above or just below the tree canopy (Crowley & Garnett, 2000). They forage mainly over open forest, woodland and mallee communities rich in passerines but also adjoining heaths and other low scrubby habitat. The species also shows a particular preference for timbered watercourses. Preferred habitat is characterised by profusely

flowering eucalypts and associated nectarivorous birds (Debus, 1998). Nesting territories tend to be located in extensive un-fragmented forests on productive soils (Debus & Czechura, 1989) and nests are usually located high (between 8-26m above ground) in mature living *Eucalyptus* or *Angophora* spp., located near water.

L. isura has previously been recorded within the Kiama area (Figure 7). There is suitable habitat for the species along Hyams Creek. Considering the fragmentation condition of the forest in the subject site and locality the more extensive foraging and nesting habitat in forest and woodland within adjoining National Parks to the west on the escarpment are likely to represent more suitable habitat.

There has not been a sighting of *L. isura* in the subject site during the targeted surveys nor has there been a nest of any raptor recorded. On this basis of the above, it is not 'likely' that the proposed rezoning for a residential sub-division will result in 'a significant effect' on the *L. isura* individuals or a population.

Little Eagle

The Little Eagle (*Hieraaetus morphnoides*) is a medium-sized bird of prey that occurs in two colour forms: either pale brown with an obscure underwing pattern, or dark brown on the upperparts and pale underneath, with a rusty head and a distinctive underwing patter of rufous leading edge, pale 'M' marking and black-barred wingtips. Both forms have a black-streaked head with a slight crest, a pale shoulder band on the upperwings, a rather short and square-tipped barred tail, and feathered legs. The species is listed as vulnerable under the TSC Act.

H. morphnoides occupies open eucalypt forest, woodland or open woodland. Sheoak or acacia woodlands and riparian woodlands of interior NSW are also used. Nests in tall living trees, where pairs build a large stick nest in winter. Lays two or three eggs during spring, and young fledge in early summer. Preys on birds, reptiles and mammals, occasionally adding large insects and carrion.

H. morphnoides is found throughout the Australian mainland excepting the most densely forested parts of the Dividing Range escarpment. It occurs as a single population throughout NSW.

The little eagle was not recorded during targeted surveys of the study and has not been recorded in the area over the last 7 years (Atlas of Wildlife). The subject site is likely to represent a very small area of potential foraging for this species and it is highly unlikely to represent a significant portion of an individual's home range, if present.

The absence of the species during targeted surveys, suggest that *H. morphnoides* is unlikely to be present in the study area. On this basis of the above, it is not 'likely' that the proposed rezoning for a residential sub-division will result in 'a significant effect' on the *H. australiacus.*

Spotted Harrier

The Spotted Harrier occurs in grassy open woodland including acacia and mallee remnants, inland riparian woodland, grassland and shrub steppe (e.g. chenopods) (Marchant and Higgins 1993; Aumann 2001a). It is found most commonly in native grassland, but also occurs in agricultural land, foraging over open habitats including edges of inland wetlands. The species builds a stick nest in a tree and lays eggs in spring (or sometimes autumn), with young remaining in the nest for several months. Generation length is estimated as 10 years (Debus and Soderquist 2008).

The diet of the Spotted Harrier includes terrestrial mammals, (e.g. bandicoots, bettongs and rodents: Van Dyck and Strahan 2008) birds and reptiles, occasionally large insects and rarely carrion (Marchant and Higgins 1993; Aumann 2001b).

The Spotted Harrier occurs throughout the Australian mainland, except in densely forested or wooded habitats of the coast, escarpment and ranges, and rarely in Tasmania (Barrett *et al.* 2003). Individuals disperse widely in NSW and comprise a single population.

The absence of the species during targeted surveys, suggest that the Spotted Harrier is unlikely to be present in the study area. On this basis of the above, it is not 'likely' that the proposed rezoning for a residential sub-division will result in 'a significant effect' on the Spotted Harrier.

Little Lorikeet

The Little Lorikeet (*Glossopsitta pusilla*) is a small bright green parrot, with a red face surrounding its black bill and extending to the eye. The species is listed as vulnerable under the TSC Act. The distribution of the Little Lorikeet extends from just north of Cairns, around the east coast of Australia, to Adelaide. In New South Wales Little Lorikeets are distributed in forests and woodlands from the coast to the western slopes of the Great Dividing Range, extending westwards to the vicinity of Albury, Parkes, Dubbo and Narrabri (Barrett et al. 2003).

There is no evidence of regular migration, but the Little Lorikeet are generally considered to be nomadic (Higgins 1999), with irregular large or small influxes of individuals occurring at any time of year, apparently related to food availability. Little Lorikeets mostly occur in dry, open eucalypt forests and woodlands. They have been recorded from both old-growth and logged forests in the eastern part of their range, and in remnant woodland patches and roadside vegetation on the western slopes.

The Little Lorikeet feed primarily on nectar and pollen in the tree canopy, particularly on profusely-flowering eucalypts, but also on a variety of other species including, melaleucas and mistletoes. The Little Lorikeet appear to prefer nesting hollows at heights of between 2 m and 15 m, mostly in living, smooth-barked eucalypts, especially Manna Gum (*Eucalyptus viminalis*), Blakely's Red Gum (*E. blakelyi*) and Tumbledown Gum (*E. dealbata*) (Courtney & Debus 2006). Within the subject site there is no suitable nesting hollows. The breeding season extends from May to September (Higgins 1999) and as long as eucalypt nectar and pollen are available throughout this period, two broods of fledglings can be raised in a season. Clutches are of three to five eggs (Higgins 1999) and broods of three and four young have been recorded, with a single fledgling recorded from one nest (Courtney & Debus 2006).

No known breeding sites have been recorded for the Little Lorikeet in the literature. There is one local record of the Little Lorikeet from 1992 in Barren Grounds Nature Reserve (Figure 7), but they have not been recorded within the subject site or the Jamberoo area. This suggests that the Little Lorikeet is unlikely to be regularly present in the subject site or breeding locally. Given the absence of forest or woodland and absence of suitable hollows, it is highly 'unlikely' that the proposed rezoning for a residential sub-division will 'significantly affect' the Little Lorikeet.

Superb Fruit Dove

The Superb Fruit Dove's NSW distribution ranges from northern NSW to as far south as Moruya (DEC 2005). It is found in rainforests, closed forests (including mesophyll vine forests) and sometimes in eucalypt and acacia woodlands where there are fruit-bearing trees (Higgins and Davies 1996). It forages in the canopy of fruiting trees such as figs and palms. Nests are constructed high in the canopy throughout September to January (DEC 2005).

No known breeding sites have been recorded for the Superb Fruit Dove in the literature. There a two local records of the Superb Fruit Dove from 2009 on Saddleback Mountain (Figure 7), but they have not been recorded within the subject site. Considering the small amount of potential foraging habitat and relative lack of nesting habitat suggests that the Superb Fruit Dove is unlikely to be regularly present in the subject site or breeding locally. It is highly 'unlikely' that the proposed rezoning for a residential sub-division will 'significantly affect' the Superb Fruit Dove.

Pink Robin

The Pink Robin (*Petroica rodinogaster*) is a small tubby bird, and is easily over-looked, being quieter than other robins The male Pink Robins have a sooty black throat and upperparts. The wings have faint, tan-buff wing-bars. The breast and belly are deep lilac-pink, and there is a small white patch on the forehead. The tail is plain, making this species the only 'red' robin with no white markings on the tail. It differs from the similar, and more common Rose Robin (*P. rosea*), which is dark grey above, with a deeper rose-pink breast and white belly, and white outer tail feathers. The female has warm olive-brown upperparts and cinnamon-buff underparts, a buff forehead spot, and may have a slight pink wash on the breast. The chestnut-buff wings and the absence of white in the tail, distinguishes the female from all other female robins.

The Pink Robin inhabits rainforest and tall, open eucalypt forest, particularly in densely vegetated gullies. Catches prey by the perch-and-pounce method, foraging more on the ground than the more flycatcher-like Rose Robin. Insects and spiders are the main dietary items. Breeds between October and January and can produce two clutches in a season. The nest is a deep, spherical cup made of green moss bound with cobweb and adorned with camouflaging lichen, and placed in an upright or oblique fork, from 30cm to 6m above the ground, in deep undergrowth. Females do most or all of the nest building and incubate unaided, but both adults feed the nestlings. The most common call most closely resembles a snapping twig.

The Pink Robin is found in Tasmania and the uplands of eastern Victoria and far south-eastern NSW, almost as far north as Bombala. On the mainland, the species disperses north and west and into more open habitats in winter, regularly as far north as the ACT area, and sometimes being found as far north as the central coast of NSW.

There are no records of the Pink Robin in the locality. The subject site does however, contain potential habitat for Pink Robins. Despite targeted diurnal birds surveys across the subject site and surrounds being undertaken at all times of the year in 2005 and 2011 no Pink Robins were recorded.

In the absence of the species during targeted surveys, the limited suitable habitat within the study area, if the *P. rodinogaster* does occur, it is only expected to be an infrequent visitor to the study area. On this basis, it is not 'likely' that the proposed rezoning for a residential sub-division will result in 'a significant effect' on the *P. rodinogaster*.

Spotted Tailed Quoll

The Spotted-tailed Quoll (*Dasyurus maculatus*) is listed as endangered on the TSC Act and EPBC Act. It is a medium-sized marsupial carnivore with dark brown fur and white spots which are present on the body and tail. It occupies a range of environments within a disjunct distribution along the east coast of Australia, extending from south-eastern Queensland through NSW and Victoria to Tasmania (DECCW 2009c).

The Spotted-tailed Quoll is found in a variety of habitats, including sclerophyll forest and woodlands, coastal heathlands and rainforests (DECCW 2009c). Occasional sightings are made in open country,

grazing lands, rocky outcrops and other treeless areas. This species feeds on a wide variety of birds, reptiles, mammals and invertebrates and uses several 'latrines' within its territory for defecation (DECCW 2009c). It is essentially terrestrial, but is also an agile climber (DECCW 2009c).

Nesting occurs in rock shelters, hollow logs, caves or tree hollows and they use numerous dens within the home range. Estimates of home ranges vary from 800 ha to 20 km2 and individuals may move several kilometres in a night. It is a highly mobile species and there are numerous records of overnight movements of several kilometres (DECCW 2009c).

The major threats to the species are regarded as loss of habitat through clearing for agriculture and forestry, competition with introduced predators such as the Fox and Cat, and primary and secondary poisoning from Fox and Rabbit baiting (Edgar and Belcher 1995). The demise of the Dingo may have contributed to the Quolls' decline as the presence of the former may deter Foxes (NPWS 1994). Conversely, pastoral development appears to have brought benefits to the species in Tasmania (where Foxes are not present) through an increase in the numbers of prey (Green and Scarborough 1990). Mortality through human intolerance resulting from predation of domestic fowls is also implicated in the species' decline (Edgar and Belcher 1995; Watt 1993). In Tasmania the species commonly feeds on road-killed carcasses and domestic birds; the principal known causes of death in that State are road casualties and individuals killed while raiding poultry pens (Green and Scarborough 1990). Fire may also be a potential threat (Ayers et al 1996).

Most published information regarding the diet of *D. maculatus* suggests that it is an opportunistic feeder, capable of taking or scavenging a wide range of fauna and of switching diet in response to the abundance of prey. Settle (1978) reported that faecal samples in the Carrai State Forest contained insects (mostly cockroaches) during the summer months, while winter samples contained rabbit fur and bones. Several authors indicate that the species scavenges carcasses of dead domestic stock (Settle 1978) or road kills (Green and Scarborough 1990).

Belcher (1995) studied scats at 2 latrine sites in a sub-alpine area of East Gippsland (altitudes of 800 m and 700 m), and found that vertebrate fauna made up the largest component of diet at this location. This study found that sub-adult Spotted-tailed Quolls consumed mostly small mammals, while medium-sized mammals made up the largest component of adult Spotted-tailed Quolls diet, with Rabbits and Brushtail Possums being the two main prey species of the latter. Belcher also found seasonal and year to year differences in diet which appear to be related to the abundance of prey, and suggests that Rabbit control programs may have a negative effect on Quoll populations unless combined with a reduction in the number of competing introduced predators.

There is virtually no quantitative data available regarding the abundance of the Spotted-tailed Quoll in the locality or the region. However, some assumptions can be made on the basis of previous records, anecdotal evidence and habitat.

The Spotted-tailed Quoll was not detected during field surveys despite targeted field surveys across the project area. Nevertheless the remnant vegetation along Hyams Creek may on occasion provide potential habitat for the species. There are records of the species in the Atlas of NSW Wildlife within a 10 km radius of the study area, suggesting that there is potential for the species to utilise the area.

As mentioned above, the Spotted-tailed Quoll has a large home range and is active at night spending most of its time on the ground searching for food. Therefore the very limited potential habitat and potential foraging resources (Rabbits), the subject site is likely to represent only a very small part of an individual's range, if present. On this basis assuming that the Spotted Tailed Quoll does occur locally, the subject site is of relatively low significance in a local or regional context, due to its size, disturbed forest systems and proximity to other residential areas.

The absence of the species during targeted surveys in 2005 and 2011, and lack of recent local records, suggest that the Spotted-tailed Quoll is unlikely to be present in the study area. On this basis and the above, it is not 'likely' that the proposed rezoning for a residential sub-division will result in 'a significant effect' on the Spotted-tailed Quoll.

4.4.3 Migratory Species

A large number of bird species listed under the migratory species provisions of the Commonwealth EPBC Act have been recorded within 10km of the subject site (Appendix D). Those species listed pursuant to the Act comprise migratory species protected by International Agreements with other countries including between, Australia and China (CAMBA), Australia and Japan (JAMBA), Australia and the Republic of Korea (Rokamba) and the Bonn Convention or the convention on the conservation of migratory species of wild animals, as well as additional species which belong to a number of bird families nominated by DEWHA. The subject site does not provide significant or important habitat for the migratory species listed under International Migratory Bird Agreements and is unlikely to be of critical significance for the other listed 'migratory' birds.

The Cattle Egret, originally found in Africa, Europe and Asia, is now found on nearly every continent, with birds in Australia originating from Asia. The Cattle Egret is widespread and common according to migration movements and breeding localities surveys. Two major distributions have been located; from north-east Western Australia to the Top End of the Northern Territory and around south-east Australia. In Western Australia and the Northern Territory, the Cattle Egret is located from Wyndham to Arnhem Land. In south-east Australia it is found from Bundaberg, inland to Roma, Thargominda, and then down through Inverell, Walgett, Nyngan, Cobar, Ivanhoe, Balranald to Swan Hill, and then west to Pinnaroo and Port Augusta (Marchant & Higgins 1990).

The Cattle Egret is found in grasslands, woodlands and wetlands, and is not common in arid areas. It also uses pastures and croplands, especially where drainage is poor. It will also forage at garbage dumps, and is often seen with cattle and other stock. The Cattle Egret and this species was recorded in agricultural lands north of Illaroo road and not on the study area. The proposed residential development is highly unlikely to impose an adverse impact on this species given the wide variety of habitats it utilises and the small area of habitat to be removed compared to that in the surrounding locality and region.

The remaining migratory species are those listed under the EPBC Act in broad family classifications (e.g. ducks, waders and raptors). The latter group includes partially nomadic species (e.g. Black Shouldered Kite, Whistling Kite, Collared Sparrowhawk and Australian Kestrel), those that are dispersive in response to seasonal changes, water availability and suitable breeding habitat (e.g. Australian Wood Duck). Many of the listed migratory species are actually sedentary in parts of their respective ranges, in particular established breeding pairs and in areas where suitable habitat is available all year round. Whilst the subject site provides suitable habitat for some of these species, the habitats present are not considered to constitute 'important' habitat critical for the conservation of such species in the locality or region.

A number of additional migratory bird species listed under International Migratory Bird Agreements which have been previously recorded in the locality of the subject site (within 10km), including pelagic species (eg. petrels, shearwaters, albatross, tropicbirds) and shorebirds (eg. sandpipers and knots) would not occur in the subject site given an absence of suitable habitat. These species are not considered of relevance to the proposed rezoning for a residential development.

4.4.4 Koala Habitat

State Environmental Planning Policy No. 44 - Koala Habitat Protection (SEPP 44) is intended "to encourage the proper conservation and management of areas of natural vegetation that provide habitat for koalas over their present range". SEPP 44 aims to protect the Koala and its habitat by incorporating prescriptions for consent authorities to consider during the assessment of Development Applications (DAs).

The application of SEPP 44 involves an iterative process including:

- establishing that the Policy applies (ie the site is >1ha and in a relevant LGA);
- determining whether the land constitutes "potential koala habitat" (pursuant to the definition); and
- documenting whether the land constitutes "core koala habitat" (pursuant to the definition).

Where land is identified as constituting, or including, areas of "core koala habitat", a Plan of Management must be prepared before development consent can be granted. The Policy encourages the inclusion of "core koala habitat" in Environmental Protection Zones.

The policy does not apply to this proposal because the land is within the Kiama Local Government Area which is not land to which the policy applies. In any case, when a development application is made, an assessment pursuant to SEPP No. 44 would conclude that the subject site is not *potential koala habitat* as the subject site does not contain any of the Koala Feed Tree Species listed in Schedule 2 of the policy.

5. Potential Impacts

5.1 Vegetation Clearance

The vegetation clearance required for any proposed residential development. However, the vegetation removed to establish such a proposal would be primarily limited to introduced pasture, some planted paddock trees and gardens surrounding the residence on Lot 1. Apart from those weedy species which would be removed as part of the rehabilitation of the Illawarra subtropical Rainforest along Hyams Creek no native remnant vegetation would be impacted.

Vegetation clearance would not result in the isolation or fragmentation of vegetation in the area, moreover enhancement of native vegetation along Hyams Creek may improve habitat connectivity north and south of the subject site.

5.2 Loss of fauna habitat

There is unlikely to be any loss of hollow bearing trees, intact understorey vegetation , wetland or aquatic habitats, nor intact canopy or mid strata habitat for locally occurring species. The majority of habitat lost would comprise only introduced pasture and the occasional planted tree. No limiting habitat resource for any threatened or non-threatened species is likely to be disturbed by a future residential development undertaken in the next 5 years.

5.3 Hydrological Changes

No creek lines or defined drainage lines would be impacted and Hyams Creek would be buffered from any subdivision by a set-back. Surface and sub surface drainage will be impacted but sound water management which would be required for any future residential estate design would account for these alterations and provide management infrastructure to minimise or prevent impacts downstream on Hyams Creek. It is also likely that any water detention basins or rain gardens that may be required for the future residential development's water management design would provide additional habitat for locally occurring species such as frogs, water birds etc.

5.4 Runoff and Sedimentation

There is the potential for impacts on the adjacent vegetation during construction from runoff and sedimentation if management measures are not implemented. There is the potential for nutrients, pollutants and seeds of exotic species to be transported to the native vegetation in adjacent areas. Increased nutrient levels may make conditions more suitable for exotic species and therefore result in an increase in the level of weed invasion at the site.

There is also the potential for indirect impacts on watercourses near the study area. Sedimentation can prevent growth of many groundcover species as covering the leaf surface with sediment can prevent photosynthesis. Furthermore, in areas where sediment loads are high, sprouting of new seedlings may be prevented due to the layer of sediment.

The construction methodology would need to be designed to minimise the potential for these impacts. Management measures would be defined by the construction environmental management plan.

5.5 Alteration of Light, Noise and Dust Levels

Artificial noise and light levels are likely to increase during construction and functioning of a residential estate. During the construction phase, altered noise, dust and light levels would likely result in disturbance to some species during daylight hours. Little is known of the impacts of noise on most species. In general, however, short, sharp noises, such as those associated with sirens or the use of compressed air, are thought to be more disturbing than low level background noise to which species can become habituated. Noise may disturb birds and mammals, and may result in some roosting and foraging areas close to the proposed development becoming unsuitable during construction.

Considering the subject site is currently highly impacted and the vertebrate species present are known to tolerate or prefer habitat in the urban interface and that the subject site is already proximal to existing residential areas and has been used for agricultural purposes for many years the increased noise and light associated with any future residential design is likely to have minimal impacts on the residual environs.

Similarly, during construction airborne dust levels are likely to increase. Large amount of airborne dust can smother plants when it coats the leaves and other parts of the plant. Much of the site has previously been ploughed for agricultural purposes and the residual native flora in Hyams Creek is unlikely to greatly affected by soil disturbances resulting from earth moving equipment during the construction of a residential development. The vegetation along the creek line will be buffered from any future development through the establishment of a vegetated corridor. .

Similarly, the site and adjacent creek has been subjected to soil profile disturbances through ploughing, cattle or other stock grazing as well as upstream impacts from agricultural practices, roads, and other activities. With careful sedimentation controls during the construction of any residential development the impacts of waterborne sediments would be attenuated possibly to better than current levels.

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6. Assessment of likely impacts on threatened species, populations and ecological communities

Whilst there is no detailed residential development proposal for the subject site at this stage, this report tests the scenario whereby the entirety of the subject site is developed for residential purposes. Consequently, the report includes an assessment of this development scenario on threatened species, populations, and ecological communities listed under the *TSC Act*.

Under the NSW Environment Planning and Assessment Act 1979 (EP&A Act), an assessment of the impacts of the proposed works on land that is critical habitat or is likely to affect threatened species, populations, or ecological communities, or their habitats listed under the TSC Act, must be undertaken in the form of an Assessment of Significance. This involves assessing the potential impacts of a proposal based on seven criteria. These criteria aid in assessing if the proposal is likely to have a significant impact on threatened species or their habitat, or endangered ecological communities which may occur at a site or have the potential to occur. If the Assessment of Significance concludes that a significant impact is likely then a Development Application must be accompanied by a Species Impact Statement (SIS).

An Assessment of Significance was carried out for the following species and ecological communities:

- Illawarra Subtropical Rainforest
- Greater Broad-nosed Bat
- Large-footed Myotis

The complete 'seven part tests' can be found in Appendix C and summaries of the assessment are provided below.

6.1 Assessment of Threatened Populations likely to be affected (TSC Act 1995)

No threatened populations are likely to be impacted by direct or indirect impacts of the proposed rezoning for a development.

6.2 Assessment of Critical Habitat likely to be affected (TSC Act 1995)

No critical habitat is likely to be impacted by direct or indirect impacts of the proposed rezoning for a residential development.

6.3 Impacts on Vegetation Communities

The proposal is for a rezoning of the subject site for residential purposes. The future development of the subject site for residential purposes is unlikely to require additional clearing of remnant native vegetation along the Hyams Creek corridor, as this vegetation is likely to be retained within a riparian buffer zone. The vegetation likely to be affected by future residential development comprises grazing pastures dominated by exotic species. Recommendations to mitigate the impacts of the proposal on the native vegetation within the subject site are made in a subsequent section of this report.

Illawarra Subtropical Rainforest in the Sydney Basin Bioregion

Conservation status

Illawarra Subtropical Rainforest is listed as endangered on the NSW TSC Act.

Community Ecology

Illawarra Subtropical Rainforest (ISR) is a rainforest community that occupies high nutrient soils in the Illawarra region, south of Sydney. Characteristic tree species include *Baloghia inophylla* (Brush Bloodwood), *Brachychiton acerifolius* (Flame Tree), *Dendrocnide excelsa* (Giant Stinging Tree), *Diploglottis australis* (Native Tamarind), *Ficus* spp., *Pennantia cunninghamii* (Brown Beech), and *Toona ciliata* (Red Cedar). Species of *Eucalyptus*, *Syncarpia* and *Acacia* may also be present as emergents or incorporated into the dense canopy. While rainforest canopies are generally closed, in highly disturbed stands the canopy of ISR may be irregular and open. The height of the canopy varies considerably, and structurally some stands of ISR are scrub.

Distribution details at the study site, locality and region

Illawarra Subtropical Rainforest has been recorded from the local government areas of Wollongong City, Shellharbour City, Shoalhaven City and Kiama Municipality (within the Sydney Basin Bioregion) and may occur elsewhere in the Bioregion.

Illawarra Subtropical Rainforest occurred mainly on the coastal Permian volcanics, but can occur on a range of geological substrates, mainly between Albion Park and Gerringong (termed the Illawarra Brush by Mills and Jakeman 1995) and north of Lake Illawarra on the Berkeley Hills (termed the Berkeley Brush by Mills & Jakeman 1995). The Illawarra Brush and Berkeley Brush originally covered about 13 600 ha and made up about 60% of the rainforest of the Illawarra area. Outlying occurrences of Illawarra Subtropical Rainforest also occur south to the Shoalhaven River and westwards into Kangaroo Valley, where areas of Permian volcanic soils occur. The community generally occurs on the coastal plain and escarpment foothills, rarely extending onto the upper escarpment slopes.

Large areas of Illawarra Subtropical Rainforest have been cleared for agriculture. Only about 3400 ha remains with about 13% of this (440 ha) in reserved areas (Mills & Jakeman 1995, L. Mitchell pers. comm). Illawarra Subtropical Rainforest occurs mainly on private land and is inadequately protected. Compared with warm temperate rainforest it is under-represented in conservation reserves.

Threatening Processes and other threats

Threats to Illawarra Subtropical Rainforest include:

- Further loss and fragmentation of habitat, particularly as a consequence of clearing for agriculture, hard rock quarrying, hobby farming, and residential development.
- Habitat degradation as a consequence of weed invasion, altered hydrological conditions, unrestricted access, grazing/trampling by livestock and feral animals, and rubbish dumping.
- Inappropriate fire regimes.

Management and Recovery Strategies

- Implement feral animal control programs, particularly for deer and goats.
- Manage sites to exclude fire.
- Consider off-site impacts (including changes to groundwater hydrology) in the assessment of nearby developments.
- Implement measures to control inappropriate water flows.

- Install fencing and signage to exclude livestock and machinery, and prevent rubbish dumping.
- Implement weed control programs.
- Protect remnants from clearing and further fragmentation.
- Restore degraded habitat using bush regeneration techniques.

The proposed development is unlikely to impose a significant effect on Illawarra Subtropical Rainforest given that the Hyams Creek Corridor containing all of the degraded rainforest would be retained and most likely rehabilitated as part of any future development, which is in line with the published recovery strategies. The creation and planting of a 5 to 10 metre riparian buffer or corridor along the banks of Hyams Creek, with species known to occur in ISR locally will in fact increase the area of habitation for this community locally and improve the connectivity along the creek corridor for floral and faunal vectors/pollinators.

6.4 Assessment of species likely to be affected (TSC Act 1995)

As highlighted above it is considered unlikely that any threatened species will be directly impacted by the proposed rezoning for a residential development however, as a consequence of (assuming development approval): clearing some trees and pastures; increased in traffic volume; provision of street lighting along the proposal a number of fauna species may be either directly impacted by habitat loss or indirectly impacted through other threatened processes. These impacts are discussed below for particular affected threatened species.

6.4.1 Flora

No threatened flora species are likely to be impacted by direct or indirect impacts of the proposed rezoning for a development

6.4.2 Fauna

The small areas of fauna habitat likely to be modified by the development of the subject site for residential purposes provide a small amount of generally marginal foraging or roosting habitat for highly mobile threatened species such as microchiropteran bats. These species would not rely on these small areas. There are no trees with hollows to be removed so the breeding of hollow-dependent fauna is highly unlikely to be disrupted.

The modification of the fauna habitats within the subject site associated with the proposal is insignificant when compared with the extent of similar habitats on lands elsewhere in the locality, the Illawarra, and the Sydney Basin Bioregion. The proposal will not sever habitat connectivity or any faunal linkages, and any linkages through the subject site to adjacent habitats will remain.

Despite this, recommendations to mitigate the impacts of any residential proposal on fauna habitats in the subject site are provided with the intention to improve the current condition of habitat values, predominantly along Hyams Creek for all locally occurring native biota.

6.4.3 Microchiropteran Bats

Two threatened bat species, the Large-footed Myotis and Greater Broad-nosed Bat are listed as Vulnerable on Schedule 2 of the TSC Act, were recorded with differing degrees of certainty from either echolocation calls or guano deposits during the surveys. Several other threatened microbats have been recorded in the locality (Table 10, Figure 7).

The Large-footed Myotis is predominantly cave roosting species that also utilises man-made structures, including drains, bridges, tunnels and mines (Dwyer, 1995). The remaining species of micro bats recorded during the 2005 Anabat surveys roosting in tree hollows (Table 8). The Greater broad-nosed and Large-footed Myotis were recorded in the Hyams Creek corridor which is likely to be the only habitat for most microbat species in the subject site. The riparian corridor is outside the proposed rezoning application area and would likely be subject to a restoration program following any development application. Thus the habitat for foraging for these species is likely to increase as a result of the creation of the riparian corridor.

There were no caves, mine adits or built structures that could serve as roosting habitat for the cave roosting species, however the steep sandstone cliff lines of the escarpment several kilometres to the west would provide numerous caves, and rock pile for these species. Similarly, these areas of intact forest and woodland would also harbour hollow-bearing eucalypts and other tree species from low to high densities and would therefore provide roosting sites for the tree roosting species.

Only one Camphor Laurel was recorded on site with a small branch hollow. This tree is outside the proposed rezoning area and would not be impacted by future residential developments

Table 8: Roosting habitat preferences of threatened microchiropteran bat species known or likely to occur within the study area.

COMMON NAME	SCIENTIFIC NAME	TREE HOLLOWS	CAVES
Yellow-bellied Sheathtail Bat	*Saccolaimus flaviventris*	Yes	No
Large-eared Pied Bat	*Chalinolobus dwyeri*	No	Yes
Eastern Bent-wing Bat	*Miniopterus schreibersii oceanensis*	No	Yes
Large-footed Myotis or Fishing Bat	*Myotis adversus*	Yes-limited	Yes
Greater broad-nosed bat	*Scoteanax rueppellii*	Yes	No
East Coast Freetail Bat	*Mormopterus norfolkensis*	Yes	No

A summary of the assessment of significance (provided in Appendix C) on the likely impacts resulting from a future residential development potentially adversely impacting threatened microchiropteran bats known or likely to occupy the subject site is provided below. The tree roosting species have similar requirements generally but particular aspects of foraging and roosting behaviour mean that these species will be affected differently. Therefore all affected microbats are discussed independently.

Large-footed Myotis (*Myotis macropus*)

Conservation status

The Large-footed Myotis (*Myotis macropus*) is listed as vulnerable on the NSW TSC Act.

Species Ecology

The Large-footed Myotis is considered to be widespread throughout the coastal regions of eastern and northern Australia, ranging from the Kimberley in Western Australia to Victoria and South Australia (Churchill, 1998). It is relatively common in tropical areas but uncommon further south (NPWS, 1994), and rare in Victoria (Menkhorst & Lumsden, 1995). Whilst regarded as having a primarily coastal distribution the Large-footed Myotis does occur further inland along major rivers (Churchill, 1998). The Minnamurra River and its major tributaries are likely to resent important foraging water bodies for the species.

Habitat requirements

This species has been recorded in mangroves, paperbark swamps and in a range of forest and woodland habitats (Churchill, 1998). Large-footed Myotis are cave dwellers but are also known to roost in tree hollows, under bridges, in clumps of vegetation and in mine tunnels and stormwater drains (Menkhorst & Knight, 2001; Churchill, 1998). Roosts are usually in close proximity to water over which the bats forage. The large feet and hind claws are used to rake the water surface for insects and small fish, and Large-footed Myotis are known to forage in small groups of three or four (Churchill, 1998). This species is also capable of foraging aerially taking moths, crickets, flies and beetles (Menkhorst & Knight, 2001).

Population details at the study site, locality and region

A potential temporary and exposed roost for this species was recorded in the Hyams Creek Channel in a shallow depression on the trunk of a Coral Tree overhanging the water. A small amount of guano was recorded at this location and no recordings of this species were captured during the 2005 Anabat surveys. Despite this, the guano is likely to be from the Large-footed Myotis as few other species are likely to roost over water in such an open situation. The macro-invertebrates and potentially small fish within the waters of Hyams Creek are likely to supply foraging resources for the Large-footed Myotis.

Although relatively widespread and abundant, the long-term security of the Large-footed Myotis is reliant on the continued presence of traditional breeding caves and over-wintering sites, and the species has been listed as threatened largely on this basis (Menkhorst and Lumsden, 1995).

Based on the information in the literature and the few records of the species in the study area, it is difficult to estimate population size or abundance. However, it is unlikely that the species is dependent on the subject site as a permanent foraging habitat at least that habitat provided by the degraded Hymas Creek.

Threatening Processes and other threats

- Loss or disturbance of roosting sites.
- Clearing adjacent to foraging areas.
- Application of pesticides in or adjacent to foraging areas.
- Reduction in stream water quality affecting food resources.

Management and Recovery Strategies

- Retain native vegetation along streams and rivers and around other waterbodies.
- Minimise the use of pesticides adjacent to foraging areas.
- Protect roosts from damage or disturbance.

Conclusion

The proposed development is unlikely to impose a significant effect on Large-footed Myotis given that:

- The Hyams Creek riparian corridor, including the creek water, and fringing vegetation would be retained as part of any future development, and improved through the creation and planting of the riparian buffer, which is in line with the published recovery strategies;
- the Large-footed Myotis is highly mobile and wide-ranging and is capable of travelling substantial distances in an evening of foraging;
- The proposed development is unlikely to result in an area of known habitat becoming isolated from currently interconnecting or proximate habitat for the Large-footed Myotis given the following;

- The proposed development will not involve the removal of or disturbance to any known maternity sites or roost sites of potential relevance for the Large-footed Myotis within the locality;

On the basis of the above considerations, it is not likely that the proposed development will involve the imposition of a significant disturbance on the Large-footed Myotis. The possible roosting location will be retained and the development of a future residential area will be situated away from the creekline thus reducing potential noise and light impact. Given the subject site is currently situated n a heavily modified and weed impacts environment adjacent to the Jamberoo township any future development is highly unlikely to impact the Large-footed Myotis.

Greater Broad-nosed Bat

Conservation Status

The Greater Broad-nosed (Scoteanax *rueppellii*) Bat is listed as vulnerable on the NSW TSC act.

Species Ecology

The Greater Broad-nosed Bat occurs along the east-coast of Australia inhabiting moist gullies and river systems from the Atherton Tableland in QLD to southern NSW. The distributional stronghold of the Greater Broad-nosed Bat is regarded as the north-east of NSW (H. Parnaby, in NPWS, 1994) particularly in the gullies and river systems draining the Great Dividing Range (Hoye & Richards, 1995).

Habitat requirements

The Greater Broad-nosed Bat is found in a variety of habitats from dry woodland to tall, wet forests but does not occur at altitudes above 500m (Hoye & Richards, 1995), except in the very north of its range where it has been recorded at 780m (Churchill, 1998). This species roosts in tree-hollows, tree branches and in the roofs of old buildings. Its flight pattern is suited to open eucalypt woodlands and forests particularly because it has limited manoeuvrability and is a noticeably slow flier. It feeds on slow flying prey (such as large moths) but will also feed on ground beetles that are 'hawked' from within 20m of the ground along rows of trees which line creeks and small rivers and the edges of patches of woodland in otherwise cleared paddocks (Churchill, 1998).

A definite recording of this species was made 2005, foraging above Hyams Creek on the western edge of the subject site. The Greater Broad-nose is likely to use the foraging habitat that occurs along egde of the remnant and introduced vegetation along the Creek and may also forage nearby the residential gardens and possibly paddock trees. There were no tree hollows recorded at the site that are likely to provide roosting habitat for this species.

Population details at the study site, locality and region

Based on the information in the literature and the few records of the species in the locality it is difficult to estimate population size or abundance. However, it is highly unlikely that the species is dependent on the subject site as a permanent foraging habitat.

Threatening Processes and other threats

- Disturbance to roosting and summer breeding sites.
- Foraging habitats are being cleared for residential and agricultural developments, including clearing by residents within rural subdivisions.
- Loss of hollow-bearing trees.

- Pesticides and herbicides may reduce the availability of insects, or result in the accumulation of toxic residues in individuals' fat stores.
- Changes to water regimes are likely to impact food resources, as is the use of pesticides and herbicides near waterways.

The Proposal is unlikely to involve any key threatening processes listed under the TSC Act or any of the other threats listed above which would affect the Greater Broad-nosed Bat.

Management and Recovery Strategies

- Raise landowners' awareness of the presence of this species, and provide information on how their management actions will affect the species' survival.
- Actively encourage the conservation of the riparian vegetation and water quality of streams and rivers.
- Conduct searches for the species in suitable habitat in proposed development areas.
- Retain stands of native vegetation, especially those with hollow-bearing trees (including dead trees), and retain other structures containing bats.
- Retain a buffer of vegetation around roost sites in vegetated areas.
- Protect hollow-bearing trees for breeding sites, including those on farmland; younger mature trees should also be retained to provide replacements for the older trees as they die and fall over.
- Reduce the use of pesticides in the environment and enter known sites of this species and its potential habitat onto maps used for planned poison spraying activities.
- Encourage regeneration and replanting of local flora species to maintain bat foraging habitat.
- Assess the site's importance to the species' survival, including linkages provided between ecological resources across the broader landscape.

Conclusion

On the basis of the above considerations, it is not likely that the proposed development will involve the imposition of a significant effect on the Greater Broad-nosed Bat. Moreover, the only observed hollow-bearing tree within the subject site will be retained and would be incorporated into the riparian buffer for any future residential subdivision plan. The Hyams creek corridor, over which this species was recorded forging, would be retained and buffered as part of a future residential development, and improved through planting of locally occurring tree and shrub species. There will be no other naturally treed areas impacted and no linkages to adjacent habitat would be severed. In fact the creation and planting of the riparian corridor is likely to improve the local connectivity for mobile species such as the Greater Broad-nosed Bat.

Given the subject site is currently situated n a heavily modified and weed impacts environment adjacent to the Jamberoo township any future development is highly unlikely to impact the Greater Broad-nosed Bat.

6.5 Assessment of species unlikely to be affected (FM Act 1994)

The *Fisheries Management Act, 1994* (FM Act) aims to conserve, develop and share the fishery resources of the state for the benefit of present and future generations. The Act, which is administered by NSW Department of Primary Industries, incorporates the principles of the TSC Act regarding the assessment of significance of impacts on threatened species and their habitat with respect to listed aquatic species.

None of the endangered populations currently listed pursuant to the FM Act is of relevance to the aquatic habitats in the study area. Consequently, the proposed development is not considered likely to impose a significant impact on any of these populations.

Two threatened fish are listed on the Protected Matters Search, however both the Macquarie Perch and Australian Grayling are highly unlikely to use the Hyams Creek or the Minnamurra River Catchment. Moreover given that Hyams Creek will be protected and buffered from any future development, thus potential habitat is unlikely to be greatly impacted. It is highly unlikely that the development will impact riparian environments downstream due to the likely water management required for any approval, and therefore unlikely that the Minnamurra River would be impacted by the proposed residential development.

6.6 EPBC Act Assessments of Significance

An assessment of the likelihood or otherwise of the proposed development imposing 'a significant effect' on The Commonwealth *Environment Protection & Biodiversity Conservation Act, 1999* (EPBC Act) establishes a process for assessing the environmental impact of activities and developments where 'matters of national environmental significance' may be affected. Under the Act any action which 'has, will have, or is likely to have a significant impact on a matter of national environmental significance' is defined as a 'controlled action', and requires approval from the Minister for the Environment.

The future residential development of the subject site may involve the clearing and/or modification of very small areas of indigenous vegetation and the matters of '*national environmental significance*' (NES) listed under the EPBC Act of potential relevance to the study site are:

- Nationally listed threatened species (e.g. Grey-headed Flying Fox); and
- Nationally listed migratory species (e.g. Cattle Egret).

6.6.1 Potential Impacts on Nationally Listed Threatened Species

Nationally listed threatened species and/or ecological communities know to occur locally and likely to utilise the subject site, if only transiently;

- Grey-headed Flying Fox (*Pteropus poliocephalus*);

The subject site provides only a very small amount of foraging or roosting habitat for highly mobile fauna like the Grey-headed Flying-fox and the Large-eared Pied Bat. In addition, the areas supporting this potential habitat occur along the Hyam's Creek Riparian corridor which will not be impacted by the rezoning or any future residential developments due to the protection buffer implemented for riparian protections and flood mitigation. The proposal is thus extremely unlikely to have a significant impact on Commonwealth and Endangered or Vulnerable Species listed by the *EPBC Act* that may potentially occur in the subject site from time to time.

Similarly the numerous other species (other than those listed as subject species or species for consideration) have been previously recorded in the locality (e.g. Swift Parrot, Regent Honeyeater, and Spotted-tailed Quoll) that could potentially occur on site (see Table 12) should not be impacted by the proposal. On the basis of the field surveys and significance assessments undertaken pursuant to State legislation (see Appendix C) it is considered unlikely that any future residential development would impose a significant impact on these nationally listed threatened species even if they do occur on site transiently.

6.6.2 Potential Impacts on Migratory Species

The habitats present on site are not considered to constitute critical or important habitat for any listed species under the migratory bird provisions of the EPBC Act and the proposed development is unlikely to impose 'a significant effect' on any of the listed 'migratory' fauna species which were recorded during the fauna investigations.

6.6.3 Key Threatening Processes

The following key threatening processes are considered relevant to the proposal:

- Clearing of native vegetation (TSC Act) and land clearance (EPBC Act);
- Removal of dead wood and trees (TSC Act);
- Predation by the European Red Fox (TSC Act & EPBC Act); and
- Competition and grazing by the feral European Rabbit (TSC Act and EPBC Act)

The clearing of native vegetation/land clearance is a key threatening process for many threatened species. Clearing of vegetation along with the removal of dead wood and dead trees would result in removal of habitat for ground-dwelling and arboreal mammals as well as some bird species and reptiles. The proposal is highly unlikely to increase exacerbate this threatened process as the area to be impacted is already cleared of native vegetation.

The threat of predation on native fauna from non-native species such as the European Red Fox (*Vulpes vulpes*) currently exists within the study area. Vegetation removal may increase the risk of predation by the Fox due to the creation of large open areas to be traversed by native fauna as well as the introduction of new edges for hunting and predation opportunities. The proposal is highly unlikely to increase the risk of predation for any faunal group as the area to be impacted is already cleared of native vegetation.

The European Wild Rabbit has been recorded within the locality. Evidence of rabbit grazing and burrowing was observed within the study area during the current surveys, and mitigation measures have been recommended to prevent substantial invasion of this species.

7. Impact amelioration

7.1 Description of potential ameliorative measures

The following recommendations for impact mitigation and amelioration should be incorporated into any future residential development.

Sediment Controls

A comprehensive Erosion and Sediment and Control Plan (ESCP) should be developed and rigorously implemented during the works to protect water quality, native fish and fish habitat. The ESCP should be developed in accordance with the requirements of the NSW Department of Housing publication – Managing Urban Stormwater: Soils and Construction (1998).

Water Quality Management

A comprehensive Water Quality Management Plan should also be developed and implemented throughout the construction process. The WQMP should identify appropriate water quality parameters, provide for the regular monitoring and reporting of water quality both upstream and downstream of the site, and ensure that procedures are in place to prevent water quality impacts for construction activities. The WQMP should address the appropriate storage and bunding of fuels, oils and chemicals, the refuelling of plant and equipment, the use of materials over-water, and emergency response procedures to minimise water quality impacts following incidents or spills.

Vegetation, Riparian and Habitat Management

- The remnant vegetation along Hyams Creek should be retained within the proposed planted riparian buffer zone of between 5 to 10 metres from the creek.
- The riparian buffer zone should be subject to a Vegetation Management Plan (VMP) prepared by a suitably qualified person.
- Vegetation within the riparian buffer zone should not be disturbed except in accordance with the VMP.
- The one hollow bearing Camphor Laurel along Hyams Creek should be retained until such time that suitable native species provide similar roosting opportunities or the hollow is found not to harbour threatened or non-threatened hollow-dependent fauna species following sufficiently detailed surveys undertaken prior to its removal. The location of this tree is shown in Figure 3 (Appendix A).
- Remnant vegetation is to be appropriately protected during the construction phase of any future residential development.
- Drainage from any future residential development should be designed so as to minimise the potential for erosion, adverse impacts on water quality, or any other significant alterations to the natural flow regime of Hyams Creek.
- The VMP should include a Weed Management Control Plan which clearly identifies invasive plant species so that none are brought into the study area or become established.
- The VMP should also cover and manage exotic perennial grasses in accordance with the Final Determination of the NSW Scientific Committee for the key threatening process “Invasion of native plant communities by exotic perennial grasses”.

8. Conclusion

This report describes the biological environment of Lot 100 DP 1063277 Wyalla Road Jamberoo and adjoining Lot 1, DP 781781, and assesses the potential effects on threatened species, migratory species, and endangered populations and ecological communities or their habitats, of a future residential development proposal on the land in the context of its proposed rezoning for residential purposes.

Two threatened microbat species, the Greater Broad-nosed Bat and Large-footed Myotis were potentially recorded within the subject site. The subject site was also found to contain a small heavily disturbed remnant of the endangered ecological community the Illawarra Subtropical Rainforest, along part of Hyams Creek. No other threatened populations, communities or species listed on the schedules of the *NSW Threatened Species Conservation Act 1995,* Fisheries Management Act 1994 or the *Commonwealth Environment Protection and Biodiversity Conservation Act 1999* were detected in the study area.

'7 part tests' under Section 5A of the *NSW Environmental Planning and Assessment Act 1979*, were conducted for the two threatened microbats and Illawarra Subtropical Rainforest as required by the *NSW Threatened Species Conservation Act 1995* and the *NSW Fisheries Management Act 1994* and all concluded that that a future residential development proposal is not likely to have a significant effect on threatened biota or their habitats. A Species Impact Statement is not required for the proposal.

Following consideration of the administrative guidelines for determining significance under the *Commonwealth Environment Protection & Biodiversity Conservation Act 1999*, it is concluded that a future residential development proposal is unlikely to have a significant impact on matters of National Environmental Significance, and a referral to the Commonwealth Environment Minister is not necessary.

A number of impact mitigation and amelioration strategies have been recommended that should be adopted for a future residential development proposal and these are set out in the section below. These strategies would mitigate the effects of such a proposal on threatened species or their habitats and minimise the impacts on the flora and fauna values of the subject site in general and may improve the available habitat and would certainly aid in the recovery of the Rainforest Community along Hyams Creek.

8.1 Potential Conservation Outcome

It is considered that the likely limited adverse impacts of any future development on the subject site would be adequately offset and possibly improved through the retention and management of the Hyams Creek Riparian Corridor for conservation purposes, which currently only extends to 1 or 2 metres beyond the top of the channel at best. Improvements, such as planting of indigenous plant endemic to Illawarra Subtropical Rainforest within a much broader corridor (5- 10 metres) and through works detailed in a suitable Vegetation Management Plan, would over time, improve the existing state of the Illawarra Subtropical Rainforest in Hyams Creek adjacent to Lots 1 and 100 and may also aid in promoting this community further up and down stream than currently occurs through natural vectors. The long term managed and natural repatriation of this community along the riparian areas would improve water quality, improve bank stability as well as improve habitat for locally occurring native flora and fauna species.

The removal of high intensity grazing as currently occurs and installation of engineered water quality controls may also improve local water quality. The establishment of a buffer without grazing along Hyams Creek managed by a VMP has the potential to result in a net increase in the total area of Native vegetation locally and to improve the condition and connectivity of areas of currently modified woodland and riparian habitats (where appropriate) hence making a positive contribution to the conservation of biodiversity on the study site and the wider locality. The funding to undertaken this work may be sourced from a suitable residential sub-division.

9. Additional information

9.1 Licensing

OMVI Ecological is licensed to undertake all flora and fauna surveys for the proposal under the following licenses

- DECC Scientific License SL100051 (expiry 31 March 2013);
- DPI Animal Care and Ethics Committee approval number 11/1182 (expiry 21 March 2013)

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Appendix A

Flora and Fauna Lists

Table 9: Cumulative Flora List for the Subject site

FAMILY	SCIENTIFIC NAME	COMMON NAME	2005 SURVEYS	2011 SURVEYS					
			(BES)	LOT 100	LOT 1	Q 1	Q 2	Q 3	Q 4
ACANTHACEAE	*Pseuderanthemum variabile*	Pastel Flower		1					
ACERACEAE	*Acer palmatum**	Japanese Maple			1				
ADIANTACEAE	*Adiantum formosum*	Giant Maiden Hair		1	1				
ADIANTACEAE	*Adiantum hispidulum*	Rough Maiden Hair	1	1	1	M			
AGAVACEAE	*Agave americana**	Century Plant	1	1					
AGAVACEAE	*Yucca elephantipes**	Yucca			1				
ALISMITACEAE	*Damasonium minus*	Star Fruit	1						
ALOACEAE	*Aloe vera**	Aloe Vera			1				
AMARANTHACEAE	*Alternantha pungens**	Khaki Weed	1						
AMARANTHACEAE	*Amaranthus sp.**	Amaranth	1						
ANTHERICACEAE/ LILIACEAE	*Chlorophytum comosum**	Spider Lily			1				
APIACEAE	*Ciclospermum leptopyhlum**	Slender Celery		1	1				
APIACEAE	*Foeniculum vulgare**	Fennel	1	1	1				
APOCYNACEAE	*Nerium oleander**	Oleander			1				
APOCYNACEAE	*Trachelospermum jasminoides**	Star Jasmine			1				
APOCYNACEAE	*Vinca major**	periwinkle		1	1				
ARACACEAE	*Phoenix canariensis**	Canary Island Date Palm			1				
ARACEAE	*Alocasia brisbaniensis*	Alocasia	1						
ARACEAE	*Monstera deliciosa**	Fruit Salad Plant			1				
ARACEAE	*Zantedeschia aethiopicum**	Arum Lily		1	1	M			
ASCLEPEDIACEAE	*Araujia hortorum**	Moth Vine	1	1	1			C	
ASPARAGACEAE	*Asparagus aethiopicus**	Asparagus Fern	1	1	1		M		
ASPARAGACEAE	*Asparagus asparagoides**	Bridal Veil Creeper		1					
ASPLENIACEAE	*Asplenium flabellifolium*	Necklace Fern	1	1					
ASTERACEAE	*Ageratina riparia**	Mist Flower	1	1	1	C	C	C	
ASTERACEAE	*Arctotheca calendula**	Capeweed		1					
ASTERACEAE	*Bidens pilosa**	Cobblers Pegs	1	1	1				
ASTERACEAE	*Cirsium vulgare**	Spear Thistle	1	1					C
ASTERACEAE	*Conyza albida**	Flea Bane	1	1	1		M		C
ASTERACEAE	*Coronopus didymus**	Lesser Swinecress		1					
ASTERACEAE	*Delairea odorata**	Cape Ivy	1	1	1			C	
ASTERACEAE	*Gazania linearis **	Gazania			1				
ASTERACEAE	*Hypochaeris radicata**	Flat Weed	1	1					
ASTERACEAE	*Senecio madagascarensis**	Fire Weed	1	1		C	C	C	C
ASTERACEAE	*Senecio minimus*	Toothed Fireweed	1						
ASTERACEAE	*Sigesbeckia orientalis*	Indian Weed	1	1	1				
ASTERACEAE	*Solvia pterosperma**	Bindii		1					
ASTERACEAE	*Sonchus asper**	Prickly Sow Thistle		1				C	
ASTERACEAE	*Sonchus olearaceus**	Milk Thistle	1	1					
ASTERACEAE	*Tagetes minuta**	Stinking Roger			1				
ASTERACEAE	*Taraxacum officinale**	Dandelion	1	1					M
BERBERIDACEAE	*Nandina domestica**	Sacred Bamboo			1				
BIGNONIACEAE	*Jacaranda mimosifolia**	Jacaranda			1				
BIGNONIACEAE	*Pandorea pandorana*	Wonga Vine	1	1	1		C		
BIGNONIACEAE	*Tecomaria capensis**	Cape Honeysuckle			1				

FAMILY	SCIENTIFIC NAME	COMMON NAME	2005 SURVEYS	2011 SURVEYS					
			(BES)	LOT 100	LOT 1	Q 1	Q 2	Q 3	Q 4
BLECHNACEAE	*Blechnum camfieldii*	Swamp Water Fern	1						
BLECHNACEAE	*Doodia aspera*	Rasp Fern	1	1	1				
BRASSICACEAE	*Cardamine hirsuta**	Flickweed			1				
BRASSICACEAE	*Rorippa microphylla*	Watercress	1						
BRASSICACEAE	*Sisymbrium officinale**	Wild Mustard		1					
CAESALPINIACEAE	*Senna pendula var. glabrata**	Easter Cassia			1				
CAPRIFOLIACEAE	*Lonicera japonica**	Japanese honeysuckle	1	1		C		M	
CAPRIFOLIACEAE	*Viburnum tinus**	Virburnum			1				
CARYOPHYLLACEAE	*Cerastium glomeratum**	Mouse Ear Chickweed		1		M			
CARYOPHYLLACEAE	*Stellaria media**	Chickweed	1	1	1			C	
CASUARINACEAE	*Casuarina cunninghamiana*	River She-oak			1				
CASUARINACEAE	*Casuarina glauca*	Swamp She-oak			1				
CASUARINACEAE	*Casuarina sp.*	Casuarina	1						
CELASTRACEAE	*Cassine australis*	Red Fruit Olive-plum	1	1					
CHENOPODIACEAE	*Chenopodium album**	Fat Hen	1	1			M		
COMMELINACEAE	*Commelina cyanea*	Scurvy Weed	1	1	1				
COMMELINACEAE	*Tradescantia flumiensis**	Wandering Jew	1	1	1	C	C	C	
CONVOLVULACEAE	*Dichondra repens*	Kidney Weed	1	1					
CONVOLVULACEAE	*Ipomea indica**	Morning Glory			1				
CRASSULACEAE	*Crassula multicava subsp multicava**	Fairy Crassula			1				
CRASSULACEAE	*Crassula sieberana subsp. sieberana*	Austral Stonecrop	1						
CUNONIACEAE	*Aphaneopetalum resinosum*	Gum Vine	1	1			C		
CUNONIACEAE	*Ceratopetalum gummiferum*	NSW Christmas Bush			1				
CUPPRESSACEAE	*Cuppressus sp.**	Cypress Pine	1						
CUPPRESSACEAE	*Juniperus virginiana**	Eastern Red Cedar		1					
CYATHEACEAE	*Cyathea australis*	Rough Tree-fern	1						
CYPERACEAE	*Carex appressa*	Carex	1	1				U	
CYPERACEAE	*Carex longebrachiata*	Drooping Carex		1					
CYPERACEAE	*Cyperus eragrostis**	Cyperus	1	1					
CYPERACEAE	*Cyperus imbecilis*	Cyperus	1						
CYPERACEAE	*Cyperus polystachyos*	Bunchy Sedge	1						
CYPERACEAE	*Cyperus rotundus**	Nut Grass		1					
CYPERACEAE	*Isolepis inundata*	Swamp Club Sedge	1						
CYPERACEAE	*Isolepis prolifer**	Scirpus		1					
DENNSTAEDTIACEAE	*Pteridium esculantum*	Bracken Fern			1				
DILLENIACEAE	*Hibbertia scandens*	Guinea Flower	1	1					
EUPHORBIACEAE	*Croton verreauxii*	Native Cascarilla		1					
EUPHORBIACEAE	*Euphorbia peplus**	Petty Spurge	1	1					
EUPHORBIACEAE	*Homalanthus populifolius*	Bleeding Heart			1				
FABACEAE	*Erythrina x sykesii**	Coral Tree	1	1	1	C	C	C	
FABACEAE	*Trifolium pratense**	Red Clover	1						
FABACEAE	*Trifolium repens**	White Clover		1					C
FABACEAE	*Wisteria sinensis**	Wisteria			1				
FUMARIACEAE	*Fumaria spp.**	Fumitory			1			C	
GENTIANACEAE	*Geranium homeanum*	Native Geranium	1	1				U	
GENTIANACEAE	*Geranium solanderi*	Cutleaf Cranesbill	1						

FAMILY	SCIENTIFIC NAME	COMMON NAME	2005 SURVEYS	2011 SURVEYS				
			(BES)	LOT 100	LOT 1	Q 1	Q 2	Q 3	Q 4
HYMENOPHYLLACEAE	*Hymenphyllum cupressiforme*	Common Filmy Fern	1						
IRIDACEAE	*Crocosmia x crocosmiifolia**	Montbretia		1		U			
IRIDACEAE	*Dietes iridioides**	Wild Iris			1				
JUNCACEAE	*Juncus usitatus*	Common Rush	1	1			M		
LAMIACEAE	*Origanum vulgare**	Oregano			1				
LAMIACEAE	*Plectranthus parviflorus*	Cockspur Flower	1						
LAMIACEAE	*Prunella vulgaris*	Self Heal	1						
LAMIACEAE	*Stachys arvenis**	Stagger Weed		1				C	
LAURACEAE	*Cinnamomum camphora**	Camphor Laurel	1	1	1		C	C	
LAURACEAE	*Cryptocarya microneura*	Murrogun		1					
LILIACEAE	*Agapanthus orientalis**	Agapanthus			1				
LILIACEAE	*Allium sativum**	Garlic			1				
MALVACEAE	*Hibiscus heterophyllus*	Native Hibiscus	1	1					
MALVACEAE	*Hibiscus rosa-sinensis**	Hibiscus			1				
MALVACEAE	*Modiola caroliniana**	Creeping Mallow		1	1				
MALVACEAE	*Modiola parviflora**	Mallow		1					
MALVACEAE	*Sida rhombifolia**	Paddys Lucerne	1	1	1		M	C	
MELIACEAE	*Melia azaderach var. australasica*	White Cedar			1				
MELIACEAE	*Toona ciliata*	Australian Red Cedar			1				
MIMOSACEAE	*Acacia binervata*	Two Veined Hickory	1	1	1				
MIMOSACEAE	*Acacia maidenii*	Maidens Wattle	1	1	1				
MORACEAE	*Ficus coronata*	Sandpaper Fig	1	1					
MORACEAE	*Ficus macrophylla*	Moreton Bay Fig			1				
MORACEAE	*Streblus brunonianus*	Whalebone Tree	1	1			M		
MYRTACEAE	*Austromyrtus dulcis*	Midgen Berry			1				
MYRTACEAE	*Backhousia myrtifolia*	Grey Myrtle	1	1					
MYRTACEAE	*Callistemon viminalis*	Weeping Bottle Brush			1				
MYRTACEAE	*Eucalyptus leucoxylon**	Yellow Gum			1				
MYRTACEAE	*Eucalyptus maculata**	Spotted Gum			1				
MYRTACEAE	*Eucalyptus microcorys**	Tallowwood			1				
MYRTACEAE	*Eucalyptus sideroxylon**	Mugga Ironbark			1				
MYRTACEAE	*Syzigium australe*	Brush Cherry	1	1					
NYCTAGINACEAE	*Bougainvillea sp.**	Paper Flower			1				
OCHNACEAE	*Ochna serrulata**	Mickey Mouse Bush		1					
OLEACEAE	*Jasminum polyanthum**	Jasmine			1				
OLEACEAE	*Ligustrum lucidum**	Large Leaf Privet	1	1	1	C	C	C	
OLEACEAE	*Ligustrum sinensis**	Small Leaf Privet	1	1	1	C	C	C	
OLEACEAE	*Notelaea venosa*	Smooth Mock Olive		1			I		
OLEACEAE	*Notelea longifolia*	Large Mock Olive	1						
ONAGRACEAE	*Fuchsia sp.**	Fuchsia			1				
ONAGRACEAE	*Ludwigia peploides subsp. montevidensis**	Water Primrose	1						
OXALIDACEAE	*Oxalis sp.**		1	1					
PASSIFLORACEAE	*Passiflora caerulea**	Wild Passionfruit			1				
PHILESIACEAE	*Geitonoplesium cymosum*	Scrambling Lily		1	1				
PHYLLANTHACEAE	*Glochidion ferdinandi*	Cheese Tree	1	1				U	
PHYTOLACCACEAE	*Phytolacca octandra**	Ink Weed	1		1				
PINACEAE	*Pinus radiata**	Radiata Pine			1				

FAMILY	SCIENTIFIC NAME	COMMON NAME	2005 SURVEYS	2011 SURVEYS					
			(BES)	LOT 100	LOT 1	Q 1	Q 2	Q 3	Q 4
PITTOSPORACEAE	*Pittosporum multiflorum*	Orange Thorn	1	1					
PITTOSPORACEAE	*Pittosporum undulatum*	Sweet Daphne	1	1				M	
PLANTAGINACEAE	*Plantago lanceolata**	Common plantain	1	1				C	C
POACEAE	*Axonopus affinis**	Narrow Leaf Carpet Grass	1						
POACEAE	*Bromus cartharticus**	Prairie Grass	1	1	1		I		
POACEAE	*Cynodon dactylon*	Couch	1	1			C		
POACEAE	*Dactylis glomerata**	Cocksfoot	1						
POACEAE	*Digitaria didactyla**	Blue Couch		1	1	M	M	M	
POACEAE	*Echinopogon caespitosus*	Tufted Hedgehog Grass	1						
POACEAE	*Erharta erecta**	Panic Veldt Grass	1	1		C	C	C	
POACEAE	*Erinochloa crus-gali**	Barnyard Grass	1						
POACEAE	*Lolium perenne**	Annual Ryegrass	1	1	1	C			C
POACEAE	*Microlaena stipoides*	Weeping rice grass	1	1		U			
POACEAE	*Oplismenus aemulus*	Basket Grass	1	1	1				
POACEAE	*Oplismenus imbecillis*	Basket Grass	1	1					
POACEAE	*Paspalum dilatatum**	Paspalum	1	1					U
POACEAE	*Pennisetum clandestinum**	Kikuyu	1	1	1				C
POACEAE	*Poa annua**	Winter Grass			1				
POACEAE	*Sporobolus fertilis**	Giant Parramatta Grass		1	1				
POACEAE	*Sporobolus sp.**	a Parramatta Grass	1						
POACEAE	*Stenotaphrun secundatum**	Wild Buffalo Grass		1					
POLYGONACEAE	*Persicaria capitata**	Knotweed	1						
POLYGONACEAE	*Persicaria decipiens*	Spotted Water Pepper	1						
POLYGONACEAE	*Persicaria hydropiper*	Water Pepper	1	1					
POLYGONACEAE	*Persicaria lapathifolia*	Pale Knotweed		1				C	
POLYGONACEAE	*Polygonum aviculare**	Wireweed		1					
POLYGONACEAE	*Rumex crispus**	Curled Dock		1	1	C	U	C	
POLYGONACEAE	*Rumex sp.**	Dock	1						
POLYPODIACEAE	*Pyrrosia rupestris*	Rock Felt Fern	1	1					
PRIMULACEAE	*Anagallis arvensis**	Pimpernel	1	1		U			
PROTEACEAE	*Grevillea robusta**	Silky Oak			1				
PROTEACEAE	*Grevillea sp.**	Garden Grevillia varieties			1				
PTERIDIACEAE	*Pteris tremula*	Tender Brake		1	1				
RHAMNACEAE	*Alphitonia excelsa*	Red Ash	1	1					
ROSACEAE	*Cratageus monogyna**	Common Hawthorn	1						
ROSACEAE	*Duchesnea indica**	Mock Strawberry	1						
ROSACEAE	*Prunus persica**	Wild Peach			1				
ROSACEAE	*Pyracantha angustifolia**	Orange Firethorn	1	1			M		
ROSACEAE	*Rhaphiolepis indica**	Indian Hawthorn		1	1				
ROSACEAE	*Rubus fruticosus* (sp. agg.)*	Blackberry	1	1	1	M	M	M	
ROSACEAE	*Spiraea cantoniensis**	May Bush			1				
RUBIACEAE	*Galium aparine**	Cleavers		1	1		C	C	
RUTACEAE	*Coleonema pulchrum*	Diosma			1				
RUTACEAE	*Murraya paniculata**	Orange Jessamine			1				
SALICACEAE	*Populus alba**	Silver Leaf Poplar		1				I	
SALICACEAE	*Salix babylonica**	Weeping Willow			1			M	

FAMILY	SCIENTIFIC NAME	COMMON NAME	2005 SURVEYS	2011 SURVEYS				
			(BES)	LOT 100	LOT 1	Q 1	Q 2	Q 3	Q 4
SALICACEAE	*Salix sp.**	a Willow	1						
SAPINDACEAE	*Alectryon subcinereus*	Native Quince		1					
SAPINDACEAE	*Dodonaea viscosa var angustifolia*	Hop Bush			1				
SAPOTACEAE	*Planchonella australis*	Black Apple		1			I		
SCROPHULARACEAE	*Hebe buxifolia**	Hebe			1				
SCROPHULARACEAE	*Veronica anagallis-aquatica**	Blue Water-Speedwell		1	1			M	
SCROPHULARIACEAE	*Veronica plebia*	Veronica	1						
SINOPTERIDACEAE	*Pellaea falcata*	Sickle Fern	1	1					
SOLANACEAE	*Solanum americanum**	Glossy Nightshade		1		C			
SOLANACEAE	*Solanum mauritianum**	Wild Tobacco	1	1	1			M	
SOLANACEAE	*Solanum nigrum**	Blackberry Nightshade	1						
SOLANACEAE	*Solanum pseudocapsicum**	Madiera Winter Cherry	1	1	1				
SOLANACEAE	*Solanum seaforthianum**	Climbing Nightshade			1				
STERCULIACEAE	*Brachychiton acerifolius*	Illawarra Flame Tree			1				
STRELITZEACEAE	*Strelitzia nicolai**	Tall Bird of Paradise			1				
THEACEAE	*Camellia japonica**	Camellia			1				
THELYPTERIDACEAE	*Christella dentata*	Christella	1	1					
URTICACEAE	*Urtica incisa*	Stinging Nettle	1	1	1				
URTICACEAE	*Urtica urens**	Small Nettle		1	1			U	
VERBENACEAE	*Lantana camara**	Lantana	1	1	1		M		
VERBENACEAE	*Verbena bonariensis**	Purple Top	1						
VERBENACEAE	*Verbena rigida**	Rough Purple Top			1				C
VIOLACEAE	*Hymenanthera dentata*	Tree Violet	1						
VIOLACEAE	*Viola odorata**	Scented Violet			1				
ZINZIGERBERACEAE	*Hedychium gardneranum**	Kahill Ginger			1				
		count	**107**	**110**	**106**				

Key
***** Introduced species
Species frequencies:
C = Common
M = Moderately Common
U = Uncommon
I = Isolated (single specimens)

Table 10: Cumulative Fauna List for the Study area

FAMILY	COMMON NAME	SCIENTIFIC NAME	BES (2005-08)	OMVI (2011)
FISH			***Number of fish recorded***	**2**
	Australian Bass	*Uperoleia laevigata*	O	
	Eel	*Anquilla* sp.	O	
FROGS			***Number of frogs recorded***	**2**
MYOBATRACHIDAE	Smooth Toadlet	*Uperoleia laevigata*		C
MYOBATRACHIDAE	Common Eastern Froglet	*Crinia signifera*		C
REPTILES				**2**
SCINCIDAE	Dark-flecked Garden Skink	*Lampropholis delicata*		O,Pit
ELAPIDAE	Red-bellied Black Snake	*Pseudechis porphyriacus*		O
BIRDS				**41**
PHASIANIDAE [I]	Domestic Chickens [I]	*Gallus gallus* [I]		C - off site
ANATIDAE [M]	Australian Wood Duck [M]	*Chenonetta jubata* [M]		O,C
ANATIDAE [M]	Pacific Black Duck [M]	*Anas superciliosa* [M]	O	O
ARDEIDAE	White-faced Heron	*Egretta novaehollandiae*		O
ARDEIDAE [M]	Cattle Egret [M]	*Ardea ibis* [M]		O
ARDEIDAE	Intermediate Egret	*Ardea intermedia*		O - offsite
CHARADRIIDAE [M]	Masked Lapwing [M]	*Vanellus miles* [M]	O	O- offsite
COLUMBIDAE [I]	Spotted Turtle Dove [I]	*Streptopelia chinensis* [I]		O - offsite
COLUMBIDAE	Brown Cuckoo-dove	*Macropygia amboinensis*	O	
COLUMBIDAE	White-headed Pigeon	*Clematis aristata*	O	
CACATUIDAE	Sulphur-crested Cockatoo	*Cacatua galerita*		C - offsite
CACATUIDAE	Galah	*Cacatua roseicapilla*	O	O.C
CACATUIDAE	Little Corella	*Cacatua sanguinea*		O,C
LORIIDAE	Rainbow Lorikeet	*Trichoglossus haematodus*		O,C
PSITTACIDAE	Crimson Rosella	*Platycercus elegans*	O	O,C
HALCYONIDAE	Laughing Kookaburra	*Dacelo novaeguineae*	C	O,C
MALURIDAE	Superb Blue Wren	*Malurus cyaneus*	O	O,C
PARDOLOTIDAE	White-browed Scrubwren	*Sericornis frontalis*		O,C
PARDOLOTIDAE	Brown thornbill	*Acanthiza pusilla*		O,C
PARDOLOTIDAE	Yellow-rumped Thornbill	*Acanthiza chrysorrhoa*		O - offsite
PARDOLOTIDAE	Yellow Thornbill	*Acanthiza nana*		O,C
MELIPHAGIDAE	Red Wattlebird	*Anthochaera carunculata*		O,C
MELIPHAGIDAE	Noisy Miner	*Manorina melanocephala*		O,C
MELIPHAGIDAE	Lewin's Honeyeater	*Meliphaga lewinii*	C	O,C
MELIPHAGIDAE	Yellow-faced Honeyeater	*Lichenostomus chrysops*		O,C
MELIPHAGIDAE	Eastern Spinebill	*Acanthorhynchus tenuirostris*		O,C
CINCLOSOMATIDAE	Red Whiskered Bulbul[I]	*Pycnonotus jocosus*	O	O,C
PACHYCEPHALIDAE	Golden Whistler	*Pachycephala pectroalis*	C	
DICRURIDAE	Willie Wagtail	*Rhipidura leucophrys*		O.C
DICRURIDAE	Grey Fantail	*Rhipidura fuliginosa*		O,C
ARTAMIDAE	Grey Butcherbird	*Cracticus torquatus*		O,C
ARTAMIDAE	Magpie-lark	*Grallina cyanoleuca*	O	O,C
ARTAMIDAE	Australian Magpie	*Gymnorhina tibicen*	C	O,C
ARTAMIDAE	Pied Currawong	*Strepera graculina*		O,C
CORVIDAE	Australian Raven	*Coryus corenoides*		O,C
PTILONORHYNCHIDAE	Satin Bowerbird	*Ptilonorhychus violaceus*		O,C
PASSERIDAE	Double-barred Finch			C -offsite

FAMILY	COMMON NAME	SCIENTIFIC NAME	BES (2005-08)	OMVI (2011)
HIRUNDINIDAE	Welcome Swallow	*Hirundo neoxena*		O,C
ZOSTEROPIDAE	Silvereye	*Zosterops lateralis*		O,C
STURNIDAE [I]	Starling [I]	*Sturnus vulgaris* [I]		O,C
STURNIDAE [I]	Common Myna [I]	*Acridotheres tristis* [I]	O	O,C
MAMMALS				**14**
	Common Brushtail Possum	*Trichosurus vulpecula*		Possum box
VESPERTILIONIDAE [V]	Large footed Myotis [V]	*Myotis macropus* [V]		S poss
VESPERTILIONIDAE	Long-eared Bat	*Nyctophilus sp.*	A(d)	
VESPERTILIONIDAE [V]	Greater broad-nosed bat [V]	*Scoteanax rueppellii* [V]	A(d)	
VESPERTILIONIDAE	Eastern Broadnosed Bat	*Scotropens orion*	A(d)	
VESPERTILIONIDAE	Large Forest Bat	*Vespadelus darlingtoni*	A(d)	
VESPERTILIONIDAE	Southern Forest Bat	*Vespadelus regulus*	A(p)	
VESPERTILIONIDAE	Little Forest Bat	*Vespadelus vulturnus*	A(p)	
CANIDAE [I]	Dog [I]	*Canius familiaris* [I]		O-offsite
CANIDAE [I]	Fox [I]	*Vulpes vulpes* [I]		S
FELIDAE [I]	Cat [I]	*Felis catus* [I]		O
EQUIDAE [I]	Horse [I]	*Equus caballus* [I]		O
BOVIDAE [I]	Cow [I]	*Bos taurus* [I]	O	O
LEPORIDAE [I]	European Rabbit [I]	*Orytolagus cuniculus* [I]		O
Total vertebrates recorded across site				
		Totals	**23**	**50**

Key
I= Introduced species
V= vulnerable on the TSC Act
M=migratory on the EPBC Act

Appendix B

Assessments of Occurrence

Database searches and literature reviews were examined to determine those threatened species, populations and ecological communities that have been recorded within a 10 kilometre radius of the study area. All occurrences of threatened species are mapped in Figure 6 and Figure 7. The presence of critical habitat, threatened ecological communities and populations was determined through their presence within the region and also based on information obtained from the NSW Atlas of Wildlife and EPBC Protected Matters Search and other vegetation mapping references. Those threatened ecological communities, populations or the presence of critical habitat recorded the region are presented in Table 11. The likelihood of potential occurrence of threatened species within the subject site or immediate surrounds is assessed in Table 12.

Table 11: Assessment of likelihood of occurrence of Critical habitat, threatened ecological communities and populations within the study area

COMMUNITY NAME	TSC ACT STATUS	EPBC ACT STATUS	HABITAT ASSOCIATION	LIKELIHOOD OF OCCURRING IN STUDY AREA
Ecological Communities				
Coastal Saltmarsh in the NSW North Coast, Sydney Basin and South East Corner Bioregions	E	-	Geology / Soils: Estuarine mud flats. Topography: Intertidal zone on the shores of estuaries and lagoons often inland of Mangrove stands. Characteristic Species: Variable with elevation; Lowest-*Sarcocornia quinqueflora*; Mid-*Sporobolus virginicus*; Upper-*Juncus krausii & Baumea juncea*	**No**. No suitable habitat present. Community not discovered in the study area
Freshwater Wetlands on Coastal Floodplains of the NSW North Coast, Sydney Basin and South East Corner Bioregion (FWCF)	E	-	Geology / Soils: Silts, muds or humic loams. Topography: in depressions, flats, drainage lines, backswamps, lagoons and lakes associated with coastal floodplains. Characteristic Species: *Carex appressa, Paspalum distichum, Baumea caniculata, Phylidrum lanuginosum, Ludwigia peploides ssp. montevidensis and Myriophyllum spp.*	**No**. No suitable habitat present. Community not discovered in the study area
Bangalay Sand Forest of the Sydney Basin and South East Corner bioregions	E	-	Geology / Soils: occurs on deep, freely draining to damp sandy soils Topography: Flat to moderate slopes on sand plains within a few km of the sea and at altitudes below 100 m. Characteristic Species: *Eucalyptus botryoides, Eucalyptus pilularis, Banksia integrifolia* subsp. *Integrifolia, Banksia serrata*, *Acmena smithii*, *Casuarina glauca*, *Banksia serrata*, *Leptospermum laevigatum*, *Monotoca elliptica*, *Pittosporum undulatum*, *Dianella* spp., and *Themeda australis*.	No. No suitable habitat present. Community not discovered in the subject site
Swamp Oak Floodplain Forest of the NSW North Coast, Sydney Basin and South East Corner Bioregions (SOFF)	E	-	Geology / Soils: Alluvial soils of fluvial or estuarine origin, with significant salinity. Topography: Flood plains in areas with saline soils and flats adjoining estuaries. Characteristic Species: *Casuarina glauca.*	**No**. No suitable habitat present. Community not discovered in the study area
Swamp Sclerophyll Forest on Coastal Floodplains of the NSW North Coast, Sydney Basin and South East Corner Bioregions (SSFCF)	E	-	Geology / Soils: Waterlogged or periodically inundated humic clay loams and sandy loams. Topography: Alluvial flats and drainage lines of coastal floodplains with a recurring flood interval of less than 1:100 years. Characteristic Species: includes species such as *Eucalyptus robusta, Melaleuca quinquenervia and eucalyptus botryoides.*	**No**. No suitable habitat present. Community not discovered in the study area.
River-Flat Eucalypt Forest on Coastal Floodplains of the North Coast, Sydney basin and South East Corner bioregions	E	-	Geology / Soils: Silts, clay-loams and sandy loams. Topography: Periodically inundated alluvial flats, drainage lines and river terraces associated with coastal floodplains with a recurring flood interval of less than 1 in 100 years. Characteristic Species: *Eucalyptus tereticornis, E. amplifolia, E. botryoides, E. grandis, E. benthamii Angophora floribunda, A. subvelutina, Melaleuca decora, M. stypheloides, Backhousia myrtifolia, Casuarina cunninghamiana* and *Casuarina glauca.*	**No**. No suitable habitat present. Community not discovered in the study area.
Littoral Rainforest in the NSW North Coast, Sydney Basin and South East Corner bioregions	E	CE	Geology/soils: Sand dunes and soils derived from underlying rocks. Topography: Coastal sand dunes, hind dunes and head lands generally within 2km of the sea. Characteristic species: Predominantly rainforest species, *Syzygium leuhmannii - Acmena hemilampra, Cupaniopsis anacardioides, Lophostemon confertus, Drypetes - Sarcomelicope - Cassine - Podocarpus* and *Acmena smithii - Ficus - Livistona - Podocarpus* with emergent sclerophyll species such as *Angophora costata*, *Banksia integrifolia*, *Eucalyptus botryoides* and *Eucalyptus tereticornis*.	**No**. No suitable habitat present. Community not discovered in the study area
Illawarra Subtropical Rainforest in the Sydney Basin Bioregion	E		Geology / Soils: Illawarra Subtropical Rainforest (ISR) is a rainforest community that occupies high nutrient soils in the Illawarra region, south of Sydney. Usually found on Permian volcanic rocks, but can occur on a range of rock types. Topography: Occupies the Illawarra coastal plain and	**Yes –** modified community occur along northern section of Hyams Creek

			escarpment foothills, rarely extending onto the upper escarpment slopes. Characteristic Species: *Baloghia inophylla* (Brush Bloodwood), *Brachychiton acerifolius* (Flame Tree), *Dendrocnide excelsa* (Giant Stinging Tree), *Diploglottis australis* (Native Tamarind), *Ficus* spp., *Pennantia cunninghamii* (Brown Beech), and *Toona ciliata* (Red Cedar). Species of *Eucalyptus*, *Syncarpia* and *Acacia* may also be present as emergents or incorporated into the dense canopy.	
Milton Ulladulla Subtropical Rainforest in the Sydney Basin Bioregion			Milton Ulladulla Subtropical Rainforest is a dense forest up to 15 m tall with an emergent tree layer to 25 m tall. Geology / Soils: Confined to soils derived entirely or partially from the Milton Monzonite. Topography: The largest remnant occurs within a steep gully on Currowar Creek; however, much smaller remnants closer to the town of Milton indicate that this community would have been widespread on rolling hills throughout the area. Characteristic Species: *Claoxylon australe*, *Acmena smithii*, *Dendrocnide excelsa*, several *Ficus* species, *Syzygium australe*, *Streblus brunonianus*, *Baloghia inophylla* and *Toona ciliata*. The shrub and ground layers are generally sparse. The most common shrub species is *Citriobatus pauciflorus*. The ferns *Adiantum flabellifolium* and *Pellaea falcata* may also be present. Vines and lianas are common and include *Malaisia scandens*, *Smilax australis* and *Cissus hypoglauca*. Milton Ulladulla Subtropical Rainforest is confined to the Milton region on the South Coast of NSW. It occurs roughly between Yatteyattah in the north, Milton in the east, Croobyar Creek in the west and the upper reaches of Burrill Lake in the south. Recorded from the local government area of Shoalhaven and may occur elsewhere in the Sydney Basin Bioregion.	**No** No suitable habitat present. Community not discovered in the study area
Illawarra Lowlands Grassy Woodland in the Sydney Basin Bioregion	E	-	An ecological community from the local government areas of Wollongong City, Shellharbour City, and Kiama Municipality (within the Sydney Basin Bioregion) Geology / Soils: Berry Siltstone, Budgong Sandstone and Quaternary alluvium. Topography: Occurs on relatively gently sloping to undulating lands less than about 200 m elevation Characteristic Species: *Eucalyptus tereticornis, Eucalyptus eugenioides, Eucalyptus longifolia, Eucalyptus bosistoana* and *Melaleuca decora*.	**No**. No suitable habitat present. Community not discovered in the study area
Themeda Grassland on Seacliffs and Coastal Headlands in the NSW North Coast, Sydney Basin and South East Corner Bioregions (TGSCH)	E	-	Geology / Soils: Found on a range of substrates including old sand dunes above cliffs and on basalt headlands, and less frequently on sandstone. Topography: Seacliffs and Coastal Headlands Characteristic Species: *Themeda australis, Acacia sophorae, Banksia integrifolia* subsp*. integrifolia, Commelina cyanea, Glycine clandestina, Glycine microphylla, Hibbertia scandens, Isolepis nodosa, Kennedia rubicunda, Lepidosperma* spp*., Leptospermum laevigatum, Lomandra longifolia, Monotoca elliptica, Opercularia aspera, Pimelea linifolia, Poranthera microphylla, Sporobolus virginicus, Viola banksii, Westringia fruticosa*.	**No**. No suitable habitat present. Community not discovered in the study area.
Moist Shale Woodland in the Sydney Basin Bioregion	E		Geology / Soils: Moist Shale Woodland usually occurs on soils derived from Wianamatta Shale on high country in the southern half of the Cumberland Plain, and occurs mainly in Wollondilly local government area. Characteristic Species: Dominant canopy trees include Forest Red Gum *Eucalyptus tereticornis*, Grey Box *E. moluccana*, Narrow-leaved Ironbark *E. crebra* and Spotted Gum *Corymbia maculata*. Small trees, such as Hickory Wattle *Acacia implexa* and Sydney Green Wattle *A. parramattensis* ssp *parramattensis* are also common. The shrub layer includes *Breynia oblongifolia*, Hairy Clerodendrum *Clerodendrum tomentosum* and Indian Weed *Siegesbeckia orientalis* ssp *orientalis*.	**No**. No suitable habitat present. Community not discovered in the study area.

Robertson Rainforest in the Sydney Basin Bioregion	E	-	Robertson Rainforest is a warm or cool temperate rainforest with a generally dense structure. Robertson Rainforest has a restricted distribution in the eastern parts of the Southern Highlands of NSW. There are two main occurrences of the community within this distribution; the principal occurrence is on the Robertson Plateau around the town of Robertson on the Southern Highlands; the second is on the higher parts of the Cambewarra Range further to the south where it is less widespread. Geology / Soils: The community occurs on high nutrient soils generally from Tertiary basalts (mainly the Robertson Basalt and Kangaroo Valley Basanite),. Topography: Robertson Rainforest is found at high altitudes (500-750 m) and under high rainfalls (1000-1600 mm per annum). It has been reported from the Robertson plateau and Cambewarra Range. Characteristic Species: Robertson Rainforest is a warm temperate/cool temperate rainforest type characterised by *Quintinia sieberi, Polyosma cunninghamia* and Doryphora *sassafras*. Tree and shrub species typically associated with this rainforest type are Acmena *smithii, Acacia melanoxylon, Quintinia sieberi, Hymenanthera dentata, Coprosma quadrifida, Tasmannia insipida* and occasionally *Ceratopetalum apetalum*. Cool temperate components include *Olearia argophylla, Hedycarya angustifolia, Eucryphia moorei, Dicksonia antarctica* and *Parsonsia brownii*. Ground cover is a dense fern cover including *Lastreopsis microsora* and *Microsorum pustulatum* subsp. *pustulatum*.	**No**. No suitable habitat present. Community not discovered in the study area
Southern Highlands Shale Woodlands in the Sydney Basin Bioregion	E		Southern Highlands Shale Woodland is confined to a small area in the Southern Highlands. It occurs roughly within an area bounded by the Illawarra Escarpment in the east, Burrawang and Bundanoon in the south, Canyonleigh in the west and Berrima and Colo Vale in the north. Geology / Soils: Restricted to clay soils derived from Wianamatta Shale. Topography: Generally found on gently rolling hills, though sometimes on steeper slopes in some areas. Characteristic Species: The dominant canopy species vary across the distribution of the community. Common species throughout much of the community's range are Mountain Grey Gum *Eucalyptus cypellocarpa*, Sydney Peppermint *E. piperita*, Swamp Gum *E. ovata*, Narrow-leafed Peppermint *E. radiata* and White Stringybark *E. globoidea*. Brittle Gum *E. mannifera*, Snow Gum *E. pauciflora*, Cabbage Gum *E. amplifolia* and Rough-barked Apple *Angophora floribunda* are less common. Camden Woollybutt *E. macarthurii* occurs throughout, but appears to be most common in the south-west of the distribution of the community, around Bundanoon. The shrub layer is usually open, though there may be denser patches of shrubs in some areas. As with the canopy layer, the shrub layer of this community varies (eg. typical species in the north-eastern parts of the distribution of the community include *Oxylobium ilicifolium*, *Melalueca thymifolia* and *Olearia microphylla*, while in south-western areas these species are rare or absent and *Daviesia ulicifolia* may be locally common). The groundlayer is usually diverse and dominated by native grasses such as *Themeda australis*, *Austrostipa rudis*, *Microlaena stipoides* and *Austrodanthonia* species. Common herb species include *Gonocarpus tetragynus*, *Veronica plebeia*, *Hypericum gramineum*, *Poranthera microphylla* and *Viola hederacea*.	**No**. No suitable habitat present. Community not discovered in the study area.
Melaleuca armillaris Tall Shrubland in the Sydney Basin Bioregion	E		Occurs in the local government areas of Shellharbour and Kiama, where remnants have been recorded at Dunmore, Jamberoo Valley, and in small patches in and around Killalea State Park. Geology / Soils: Occupies very dry rocky ridges away from the coast, usually where volcanic soils overlay latite. Characteristic Species: dominated by the large Paperbark shrub, *Melaleuca armillaris* (Bracelet	**No**. No suitable habitat present. Community not discovered in the study area.

			Honeymyrtle). Characteristic tree and shrub species include *Acacia mearnsii* (Black Wattle), *Alphitonia excelsa* (Red Ash), *Commersonia fraseri* (Brown Kurrajong), *Dodonaea viscosa* ssp. *viscosa*, *Hibiscus heterophyllus* (Native Rosella), and *Prostanthera linearis*. Characteristic groundcovers include *Bracteantha bracteata* (Golden Everlasting), *Calandrinia pickeringii* (Pink Purslane), *Cheilanthes distans* (Bristly Cloak Fern), *C. sieberi* (Mulga Fern), *Commelina cyanea* (Scurvy Weed), *Crassula sieberana* (Austral Stonecrop), and *Plectranthus graveolens*.	
Robertson Basalt Tall Open-forest in the Sydney Basin Bioregion	E	-	Geology / Soils: Highly fertile soils derived from basalt. Topography: rolling hills on gentle to steep slopes. Characteristic Species: Dominant tree species include: Brown Barrel *Eucalyptus fastigata*, Manna Gum *E. viminalis*, Narrow-leafed Peppermint *E. radiata* and Mountain Grey Gum *E. cypellocarpa*. Blackwood *Acacia melanoxylon* is a common small tree species in this community. Common shrubs include *Coprosma quadrifida* and *Senecio linearifolius*	**No**. No suitable habitat present. Community not discovered in the study area
Tablelands Frost Hollow Grassy Woodlands in the South Eastern Highlands, Sydney Basin, South East Corner and NSW South western Slopes Bioregions (TFHGW)*	E	-	Geology / Soils: Occurs on a variety of substrates including granite, basalt, metasediments and Quaternary alluvium. Topography: Occurs on valley floors, margins of frost hollows, footslopes and undulating terrain approximately between 600 and 1400 m in altitude Characteristic Species: includes species such as *Eucalyptus pauciflora, E. rubida, E. stellulata*, and *E. viminalis.*	**No**. No suitable habitat present. Community not discovered in the study area.
Montane Peatlands and Swamps of the New England Tableland, NSW North Coast, Sydney Basin, South East Corner, South Eastern Highlands and Australian Alps bioregions	E	-	Geology / Soils: Accumulated peaty or organic-mineral sediments. Topography: Poorly drained flats in the headwaters of streams. It occurs on undulating tablelands and plateaus, above 400-500 m elevation, generally in catchments with basic volcanic or fine-grained sedimentary substrates or, occasionally, granite. Characteristic Species: *Baeckea* spp., *Callistemon* spp., *Leptospermum* spp., *Sphagnum* spp.	**No**. No suitable habitat present. Community not discovered in the study area

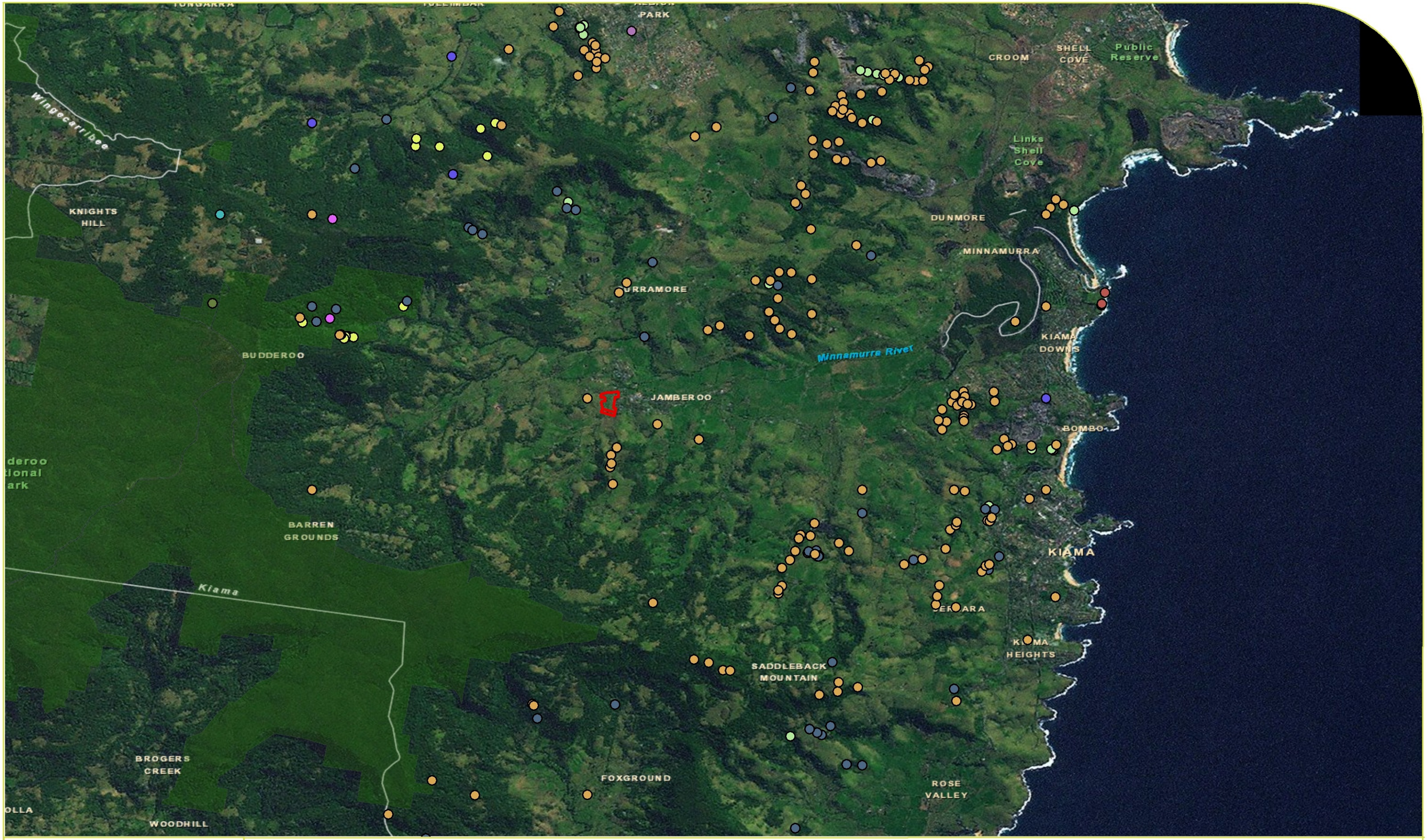

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Figure 6: Threatened Flora recorded within a ten kilometre radius of the Study Area (source OEH Atlas of Wildlife).

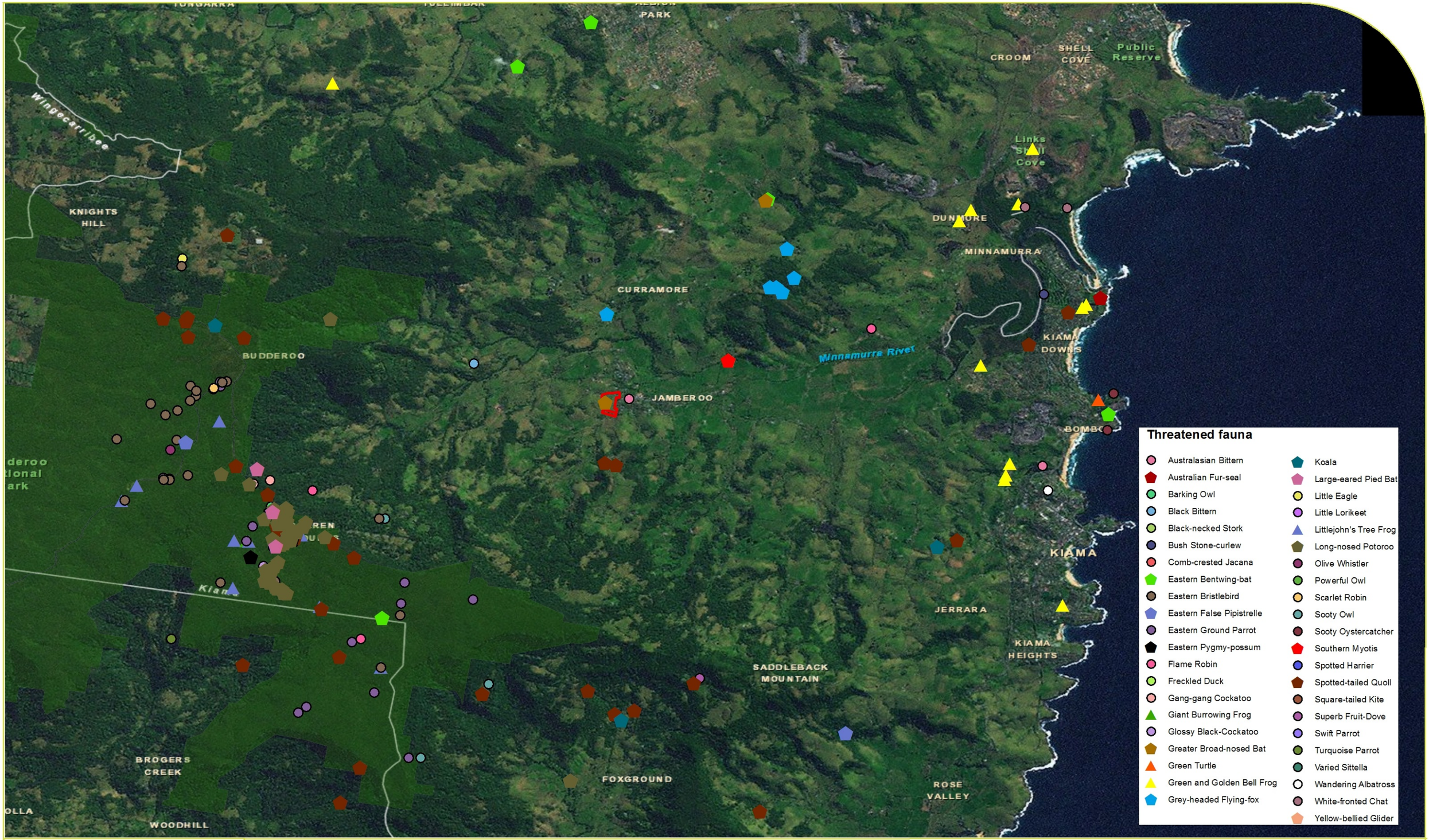

Figure 7: Threatened Fauna recorded within a ten kilometre radius of the Study Area (source OEH Atlas of Wildlife).

Table 12: Assessment of likelihood of occurrence of threatened and migratory species within the subject site and immediate surrounds.

Common Name (Species Name)	TSC Act Status	EPBC Act Status	Habitat Association	Likelihood of Occurring in Study Area
Flora				
Bynoe's Wattle ***Acacia bynoeana***	E	V	Erect or spreading shrub to 0.3 m high growing in heath and dry sclerophyll open forest on sandy soils. Often associated with disturbed areas such as roadsides. Preferring open, slightly disturbed areas such as trail edges. It is associated with canopy species such as Red Bloodwood, Scribbly Gum, Parramatta Red Gum, Saw Banksia and Narrow-leafed Apple and flowers during summer. This is a cryptic species that is difficult to identify when not in flower.	**Unlikely-** no suitable habitat present.
Downy Watlle ***Acacia pubescens***	V	V	Spreading shrub 1-4 m high growing in open sclerophyll forest and woodlands on clay soils. This species occurs on alluvium, shales, and at the intergrade between shales and sandstones. This species flowers from August to October with pods maturing in October to December although seed production appears quite low. This is a clonal species and recruitment is more commonly vegetative. Threats include habitat loss, habitat degradation, weed invasion, mechanical damage, rubbish dumping, illegal track creation, inappropriate fire regimes, disease and hybridisation (DEC 2007).	**No-** no suitable habitat present.
Sunshine Wattle ***Acacia terminalis ssp terminalis***	E	E	Erect or spreading shrub, 1.5 m high. Grows in a variety of habitats but usually in dry sclerophyll forest on sandstone, south from Tenterfield, chiefly on coasts and tablelands. This species is a bipinnate wattle that generally occurs in coastal scrub and dry sclerophyll woodland on sandy soils. Habitat is generally sparse and scattered. Most areas of habitat or potential habitat are small and isolated as well as being highly modified or disturbed due to surrounding urban development. This species flowers in autumn and is pollinated by small birds and bees. Seeds mature in November and are disbursed by ants. Seed viability is high and recruitment occurs mainly after fire. A fire temperature of 60 degrees is required for optimum germination. Although plants are killed by fire, they have been recorded sprouting from the base (DEC 2007)	**No-** no suitable habitat present. Not found during surveys
Deane's Boronia ***Boronia deanei***	V	V	Deane's Boronia is an erect shrub 0.2 m to 1.5 m high (Harden 1991) with white to bright pink flowers (Duretto 2003). Flowering occurs Aug.-Nov. (Harden 1991; Fairley & Moore 2000) with fruits in Dec. (Duretto 2003).There are scattered populations of Deane's Boronia between the far south-east of NSW and the Blue Mountains (including the upper Kangaroo River near Carrington Falls, the Endrick River near Nerriga and Nalbaugh Plateau), mainly in conservation reserves. Grows in wet heath, often at the margins of open forest adjoining swamps or along streams.	**No-** no suitable habitat present. Not found during surveys

Common Name (Species Name)	TSC Act Status	EPBC Act Status	Habitat Association	Likelihood of Occurring in Study Area
Thick Lip Spider Orchid ***Caladenia tessellata***	E	V	This species of orchid inhabits grassy sclerophyll woodland on clay loam or sandy soils, and low woodland with stony soil. Flowering generally occurs between September and November, however late flowering in September or early October has been recorded in southern populations. This species is known from Sydney (historic records), Wyong, Ulladulla and Braidwood regions in NSW. Kiama and Queanbeyan populations are presumed extinct. Records from the 1930's occur within the Huskisson area. C. tessellata occurs on the coast of Victoria from east of Melbourne to almost the NSW border. Threats to this species include clearing associated with urban development, pedestrian activity associated with recreational use along coastal areas, long-term absence of fire, and events leading to local population extinctions (DEC 2007).	**No-** no suitable habitat present. Not found during surveys
Leafless Tongue Orchid ***Cryptostylis hunteriana***	V	V	This species is a leafless, saprophytic tongue orchid, which is reliant on a symbiotic relationship with the microrrhizal fungus found in decaying plant matter. Flowering occurs between November and February, producing green, red and black flowers carried on an axillary raceme. Foliage is absent, with the leaves reduced to scales. C. hunteriana grows in a range of habitats including swampy heaths on sandy soils, scrubby swamp fringes, through to bare hillsides in tall eucalypt forest. Potential habitat typically occurs in woodland dominated by Scribbly Gum (Eucalyptus sclerophylla), Silvertop Ash (Eucalyptus sieberi), Red Bloodwood and Black She-oak. This species appears to prefer open areas in the understorey and is often found in association with the Large Tongue Orchid (Cryptostylis subulata) and the Tartan Tongue Orchid (Cryptostylis erecta). Threats include coastal development and roadwork activities, both affecting the survival of local populations (DEC 2007). Targeted surveys for the species undertaken during the flowering period failed to detect the species within the study area..	**No-** no suitable habitat present. Not found during surveys
White-flowering Wax Plant ***Cynanchum elegans***	E	E	C. elegans (Asclepiadaceae) is a climber or twiner with a highly variable form. It is a clonal species with underground suckering stems, rarely stoloniferous. Mature stems have a fissured corky bark and can grow to 10 m high and 3.5 cm thick. Leaves are opposite, rarely in whorls of three, broadly ovate to ovate, 1.5 to 15 cm long, 1.5 to 7.5 cm wide and exude a milky sap when damaged. Juvenile leaves are lanceolate to narrow lanceolate. Flowers are white, tubular, up to 4mm long, 6 to 12 mm wide and occur in cymo-umbels, few flowered clusters or umbels on branched peduncles. Flowering occurs primarily between August and May, with the peak in November (NPWS 1993). Grows in rainforest gullies, scrub & scree slopes, usually occurs on the edge of dry rainforest or littoral rainforest, but also occurs in Coastal Banksia Scrub, open forest and woodland, and Melaleuca scrub (DEC 2007). The known geographic range of the species extends from Yabbra State Forest (north-east of Tenterfield) in the north to Gerroa in the south and west to Merriwa in the Upper Hunter.	**Possible –** suitable habitat exists. Few records occur in the locality. None observed during surveys
Illawarra Socketwood ***Daphnandra johnsonii*** **(syn D.sp. C *Illawarra)***	V		*Daphnandra johnsonii* is a medium sized rainforest tree (family Monimiaceae) that is endemic to the Illawarra region of NSW. The species inhabits the rocky hillsides and gully slopes of the Illawarra escarpment and coastal lowlands, growing on soils derived from volcanic or fertile sedimentary rocks. D. *johnsonii*	**Possible –** suitable habitat exists. Few records occur in the locality. None observed during surveys

Common Name (Species Name)	TSC Act Status	EPBC Act Status	Habitat Association	Likelihood of Occurring in Study Area
			occupies the rainforest understorey. Associated vegetation includes the subtropical, moist subtropical, dry subtropical and mixed subtropical - warm temperate rainforest types of Mills & Jakeman (1995). Recorded from 36 sites on freehold land, three sites within Budderoo National. The main distribution of D. *johnsonii* extends from Avondale in Wollongong LGA to Toolijooa in Kiama LGA, a distance of 27 kilometres. An outlying site at Scarborough (northern Wollongong LGA) is located approximately 35 kilometres north of this main distribution. The species' western distributional limit follows the upper slopes of the Illawarra escarpment. The species is highly clonal and as a consequence, its total population size is expected to be low. Some sites are suspected of containing just one genetic individual.	
Albatross Mallee ***Eucalyptus langleyi***	V, EP	V	*Eucalyptus langleyi*, Family Myrtaceae, also known as Albatross Mallee, is a mallee-forming species growing to 6 m high. Its bark is smooth, grey, green or pink and sheds in long ribbons (Harden, 1991). Albatross Mallee has a very limited distribution in NSW mostly within a 17 km x 7 km area and is known from 35 sites with a total population of over 7600 plants (Mills 2010). *E. langleyi* is located predominately to the southwest of Nowra with a disjunct population north of the Shoalhaven River in the vicinity of Bomaderry Creek, near Nerang Road, Bomaderry Albatross Mallee is locally common on shallow, poorly drained sandy soil over sandstone or associated with laterite (Hill & Johnson, 1991; Brooker & Kleinig, 2006). It occurs on plateaux in highly dissected areas, often in heath patches surrounded by woodland of Red Bloodwood (*Corymbia gummifera*), Yertchuk (*Eucalyptus consideniana*) and a 'Scribbly Gum' (Hill & Johnson, 1991). Threats include habitat loss and degradation through maintenance works along road, trail, pipeline and powerline easements (DEC 2007). There is an isolated population of the Albatross Mallee that is also listed as an endangered population. The total population size of the Eucalyptus langleyi population north of the Shoalhaven River in the Shoalhaven local government area in 1998 was estimated at 32 plants but a survey in 2008 found only 20 of these still alive (Barratt *in litt*) while Mills (2010) found 25 trees. This represents a decline of ~ 22 to 38% over ten years. Reproduction has been poor in recent years and no successful recruitment has occurred within the population (Barratt *in litt*.). The Eucalyptus langleyi population north of the Shoalhaven River in the Shoalhaven local government area occurs on rocky sloping Nowra Sandstone outcrops in a highly disturbed environment that is used for recreational activities and is also impacted by weeds and rubbish dumping (Barratt *in litt*.).	**No –** habitat not present. No records occur in the locality. None observed during surveys
Ettrema Mallee ***Eucalyptus sturgissiana***	E		This species of Mallee grows to 5 m and occurs swampy sandy soils in low shrub-heath in the Northern Budawang Range in Morton National Park and nearby coastal plains of NSW. Little else is known of this species ecology. Threats include low genetic diversity due to small population size, too frequent fire, and habitat loss and degradation (DEC 2007).	**Unlikely –** habitat not present. No records occur in the locality. None observed during surveys

Common Name (Species Name)	TSC Act Status	EPBC Act Status	Habitat Association	Likelihood of Occurring in Study Area
Brittle Midge Orchid ***Genoplesium baueri***	V		A terrestrial orchid which prefers sparse sclerophyll forest and moss gardens over sandstone. Flowers from December to March. The species has been recorded from locations between Nowra and Pittwater and may occur as far north as Port Stephens.	**Unlikely –** habitat not present. No records occur in the locality. None observed during surveys
Large Midge Orchid ***Genoplesium superbum***	E		Genoplesium superbum is restricted to the southern tablelands of NSW where it has been recorded from 2 locations near Nerriga, c. 20 km apart. The species occurs predominantly in wet heathland on shallow soils above a sandstone cap but has also been found in open woodland interspersed with heath. Some plants fall within the boundary of Morton National Park. The population fluctuates from year to year and is currently estimated to contain fewer than 150 individuals (K. J. McDougall, pers. comm.).	**No –** habitat not present. No records occur in the locality. None observed during surveys
Grevillea parviflora subsp. parviflora	V	V	Open to erect shrub to 1 metre. Grows in woodland on sandy clay loam soils. The habitat for this species are broad, and are known to occur in areas supporting heath, shrubby woodland and forest and often in disturbed areas such as on the fringes of tracks. It has been known to flower over two periods throughout the year, July to December	**Unlikely –** habitat not present. No records occur in the locality. None observed during surveys
Illawarra Irene Irenepharsus trypherus	E	E	*I. trypherus* is a glabrous (hairless) annual or short lived perennial herb (family Brassicaceae). It has a spreading to erect habit and is often multi-stemmed, with stems growing to 250 cm. Occupying steep rocky slopes and cliff lines at the ecotone of sclerophyll forest and rainforest. It is known historically from 17 sites in the Illawarra and Shoalhaven regions of NSW. Ten of these sites are located on freehold land while seven sites are located within conservation reserves. The main distributional range of *I. trypherus* extends from Marshall Mount (Wollongong LGA) to Lake Yarrunga in Morton National Park (Wingecarribee LGA). Sites within this range of approximately 41 kilometres are largely confined to the upper slope of the ridge systems that extend south and east from the Illawarra escarpment (ie Stockyard Mountain, Marshall Mount, Johnstons Ridge and Hindmarsh Ridge). One site has been recorded outside this range at Ettrema Gorge in Morton National Park, approximately 29 kilometres south of Lake Yarrunga. In the Shoalhaven vegetation associations for *I. trypherus* include, *E. piperita* (Sydney Peppermint) – *E. saligna* X *botryoides* open forest and Backhousia myrtifolia low open to closed forest; Other vegetation associations include Subtropical rainforest and Mixed subtropical – warm temperate rainforest.	**Possible-** limited suitable habitat present. Several records within 10km of the study area. Not found during targeted surveys
Biconvex Paperbark Melaleuca bioconvexa	V	V	*Melaleuca biconvexa* is a shrub to small tree with papery bark growing in damp places. *Melaleuca biconvexa* occurs as disjunct populations in coastal New South Wales from Jervis Bay to Port Macquarie, but the main concentration of records is in the Gosford/Wyong area. The distribution of the disjunct southern population in the Jervis Bay area has been recently described by Mills, K. (1993).	**No –** while suitable habitat is present there are no local records and it was not discovered during surveys across the entire study area.

Common Name (Species Name)	TSC Act Status	EPBC Act Status	Habitat Association	Likelihood of Occurring in Study Area
Deane's Paperbark ***Melaleuca deanei***	V	V	This species is a shrub to 3 m high, with fibrous papery bark. It occurs in two distinct areas, in the Ku-ring-gai / Berowra and Holsworthy/Wedderburn areas. There are also more isolated occurrences at Springwood in the Blue Mountains, Wollemi National Park, Yalwal (west of Nowra), and Central Coast (Hawkesbury River) areas. It grows on sandstone and flowers in summer (DEC 2007).	**No –** no suitable habitat is present, no local records and it was not discovered during surveys across the entire study area.
Spiked Rice-flower ***Pimelea spicata***	E	E	The Spiked Rice-flower is a shrub to 50 cm tall that may be erect or somewhat prostrate in habit. The leaves are opposite and elliptical, to 20 mm long by 8 mm wide. The white, pink-tinged flowers are tubular, to 10 mm long, with four spreading petals. They may appear at any time of the year, but are mostly seen in summer. Once widespread on the Cumberland Plain, the Spiked Rice-flower occurs in two disjunct areas; the Cumberland Plain (Narellan, Marayong, Prospect Reservoir areas) and the Illawarra (Landsdowne to Shellharbour to northern Kiama). In both the Cumberland Plain and Illawarra environments this species is found on well-structured clay soils. In the coastal Illawarra it occurs commonly in Coast Banksia open woodland with a better developed shrub and grass understorey.	**No –** habitat not present. No records occur in the locality. None observed during surveys
Illawarra Greenhood ***Pterostylis gibbosa***	E	E	The Illawarra Greenhood orchid, is a deciduous terrestrial orchid known from five locations in NSW with a total estimated population of approximately 4500 individuals. Flowering in September - October, the flowers are generally pollinated by male gnats of the genus Mycomya which are most abundant during these months. Known occurrences include sites near Wollongong one site in the Hunter Valley and another site within Worrigee Nature Reserve, near Nowra. The species is associated with sclerophyll forest, sometimes with paperbarks. Suitable habitat for the Illawarra Greenhood was not found within the subject site and it therefore considered highly unlikely that this species would occur.	**Unlikely** – no suitable habitat present. Not found during targeted surveys
Waterfall or Pretty Orchid ***Pterostylis pulchella***	V	V	A terrestrial orchid generally restricted to cliff faces close to waterfalls and creek banks and mossy rocks alongside running water on the Illawarra escarpment and Southern Highlands of NSW. Flowers appear between February and May (Harden, 1993). The species has been found only at Fitzroy Falls, Belmore Falls, upper Bundanoon Creek, Minnamurra Falls (DECC, 2005) and Red Rocks Nature Reserve, where the road crosses Camberwarra Mountain.	**No-** no suitable habitat present. No local records Not found during targeted surveys
Magenta Lily Pily ***Syzygium paniculatum***	E	V	Syzygium paniculatum (Myrtaceae) is a small to medium sized rainforest tree, which grows from 3-8m high. The bark is flaky and leaves are lanceolate to obovate, 4.5-10cm long. Leaves are generally dark green and glabrous (shiny) on the upper surface and paler underneath. Plants have white inflorescences that form at the end of each branch, and it is this feature from which the species derives its name (ie. paniculate). The fruit are a spherical to ovoid berry, deep magenta in colour, and contain a single seed. S. paniculatum is a widely cultivated species available as an ornamental and garden plant. *S. paniculatum* is endemic to NSW. The species occurs in the South Coast, Central Coast and North Coast Botanical Divisions (sensu Harden 1992), in the following Local Government Areas: Great Lakes, Dungog, Lake Macquarie, Wyong, Gosford, Canterbury, Sutherland and Shoalhaven.	**Possible-** little suitable habitat present Not found during targeted surveys**.**

Common Name (Species Name)	TSC Act Status	EPBC Act Status	Habitat Association	Likelihood of Occurring in Study Area
			The south coast populations of the species are a disjunct occurrence, with no records between Towra Point and Jervis Bay (Mills 1996). At Jervis Bay on the south coast of NSW, *S. paniculatum* occurs on sandy grey soils over sandstone, restricted mainly to remnant stands of littoral rainforest. Mills (1993) described this community as composed mainly of the following tree species: *S. paniculatum, Ficus obliqua, Glochidion ferdinandi, Endiandra sieberi, Synoum glandulosum, Podocarpus elatus, Cassine australis, Notelaea longifolia, Guioa semiglauca, Acmena smithii* and *Pittosporum undulatum*.	
Solanum celatum	E		A small shrub growing in rainforest clearings, and wet sclerophyll forest. *S. celatum* is endemic to New South Wales and has been recorded from a restricted area from Wollongong to just south of Nowra, and west to Bungonia. *S. celatum* is a fire sensitive obligate seeder. The majority of records are prior to 1960 and a recent survey of six sites found only a single plant within Macquarie Pass National Park, SW of Wollongong.	**Possible** – suitable habitat present. Several records. Not found during targeted surveys
Kangaloon Sun-orchid *Thelymitra* sp. Kangaloon (D.L.Jones 18108)		CE	A recent revision of the taxonomy of the genus Thelymitra has been undertaken which proposes that the Kangaloon Sun-orchid be elevated to species status. This species has not yet been formally published (manuscript name *Thelymitra kangaloonica*) (CHAH 2009; Jeanes unpubl.). The Kangaloon Sun-orchid is a terrestrial orchid, with a green or purplish flower stem (scape) growing 20–56 cm high. The narrow fleshy leaf grows 15–35 cm long and 5–20 mm wide, and is green with a purplish base. The plant produces two to 15 dark blue flowers that are 15–32 mm across with darker longitudinal veins (Jeanes unpubl.). The Kangaloon Sun-orchid has an estimated area of occupancy of 10 km². The three localities are Butler's Swamp (0.125 km²), Stockyard Swamp (once known as Molly Morgan Swamp) (7 km²) and Wildes Meadow Swamp (3 km²), and are all located above what is known as the Kangaloon Aquifer (TSSC 2008afc).	**NO –** no suitable habitat. No local records Not found during targeted surveys
Austral Toad-flax *Thesium australe*	V	V	*Thesium australe* is a short-lived herbaceous shrub with wiry stems up to 30 cm in length. It is parasitic on the roots of other plants, particularly kangaroo grass (Themeda triandra). On the mainland this species occurs in Queensland, New South Wales and Victoria. Suitable habitat for this species includes grassland and grassy woodland Kangaroo Grass (*Themeda australis*) occurs sporadically throughout the subject site and targeted surveys for the species were undertaken in conjunction with surveys for *C. hunteriana*. The species was not detected within the subject site despite considerable survey effort and it is considered highly unlikely that the species would occur there.	**Unlikely –** limited suitable habitat. No local records Not found during targeted surveys
Illawarra Zieria *Zieria granulata*	E	E	A tall bushy shrub that grows to 6 m. The entire plant is densely covered with glandular tubercles (small wart-like outgrowths) that give a strong aroma when crushed. Restricted to the Illawarra region where it is recorded from a number of sites. The species primarily occupies the coastal lowlands between Oak Flats and Toolijooa, in the local government areas of Shellharbour and Kiama. This is a range of approximately 22 kilometres. Flowering occurs between early spring and summer. The Illawarra Zieria has been observed to coppice from damaged stems in response to physical disturbance including grazing and slashing. Seed	**Unlikely –** limited suitable habitat. Despite numerous local records it was not found during targeted surveys.

Common Name (Species Name)	TSC Act Status	EPBC Act Status	Habitat Association	Likelihood of Occurring in Study Area
			dispersal is initially through forcible ejection from the mature fruit, and it is suspected that secondary dispersal by ants also occurs. Mass germination of seeds has been observed following soil disturbance. The typical habitat is dry ridge tops and rocky outcrops on shallow volcanic soils, usually on Bumbo Latite. Less frequently found on the moist slopes of the Illawarra escarpment and in low-lying areas on Quaternary sediments. Associated vegetation includes Bracelet Honey-myrtle *Melaleuca armillaris* scrub, Forest Red Gum *Eucalyptus tereticornis* woodland and rainforest margins, although the species has been recorded from a number of other vegetation types. Much of the natural habitat for the species has been removed and many sites now occupy road verges and paddock edges.	
Warty Zieria ***Zieria tuberculata***	V	V	A rounded, open to moderately dense shrub, to 3.5 m high (Briggs & Leigh 1990; Harden 2002; Armstrong 2002) with conspicuous creamy white flowers (Armstrong 2002). Flowers appear Aug. and Sept. (Briggs & Leigh 1990) in late winter to spring, with fruits observed in summer (Armstrong 2002). Grows in heath amongst rocky outcrops on rainforest edges and in tall forest and shrubland. Now known only from Little Dromedary Mt and the lower eastern slopes of Mt Dromedary in the Central Tilba area on the South Coast of NSW, the species has a geographic range of 6 km (Briggs & Leigh 1990; Armstrong 2002). In 1931, it was collected from Good Dog Mountain in the Cambewarra Range, north of Nowra but more recent searches have failed to find the species there. Although this site is now heavily revegetated, the species may have been eliminated from the area as a result of earlier clearing and grazing (Briggs & Leigh 1990). The total known population of about 900 plants grows at eight sites (Briggs & Leigh 1990; Armstrong 2002). Four populations are on private property. Three of the smaller populations totalling about 60 plants occur within Gulaga NP (Briggs & Leigh 1996; Armstrong 2002) and the Little Dromedary Mt population is on crown land (Briggs & Leigh 1990).	**No –** no suitable habitat. No local records Not found during targeted surveys
FAUNA				
Invertebrates				
Sydney Hawk dragonfly ***Austrocordulia refracta*** **Endangered FM Act**	-	-	The Sydney hawk dragonfly has a very restricted distribution. The only known from the Hawkesbury-Nepean, Georges River and Port Hacking drainages. The closest recoding to the study area is from the Nepean River at the Maldon Bridge near Wilton. The predicted distribution includes all drainage lines immediately north of the study area, The Sydney hawk dragonfly spends most of its life underwater as an aquatic larva, before metamorphosing and emerging from the water as an adult. Adults are thought to only live for a few weeks.	**Unlikely** – no suitable habitat in the subject site
Adam's emerald dragonfly ***Archaeophya adamsi*** **Vulnerable FM Act**	-	-	Adam's emerald dragonflies are one of Australia's rarest dragonflies. Only five adults have ever been collected, and the species is only known from a few sites in the greater Sydney region. The closest known location of occurrence in Bedford Creek in the Lower Blue Mountains. Larvae have been found in small	**Unlikely** – no suitable habitat in the subject site

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			creeks with gravel or sandy bottoms, in narrow, shaded riffle zones with moss and rich riparian vegetation. Adam's emerald dragonfly larvae live for 7 years or so and undergo various moults before metamorphosing into adults. Adults probably live for a few months at most.	
Giant Dragonfly ***Petalura australis***	**E**		The Giant Dragonfly is the second largest dragonfly in Australia and one of the largest dragonflies in the world. The Giant Dragonfly is found along the east coast of NSW from the Victorian border to northern NSW. It is not found west of the Great Dividing Range. There are known occurrences in the Blue Mountains and Southern Highlands, in the Clarence River catchment, and on a few coastal swamps from north of Grafton to Nadgee. They live in permanent swamps and bogs with some free water and open vegetation. Adults are short-lived surviving for one summer after emerging in October spending most of their time settled on low vegetation on or adjacent to the swamp hunting for flying insects. Females lay eggs into moss or other soft vegetation bordering swamps. Larvae dig long branching burrows under the swamp leaving their burrows at night to feed on insects and other invertebrates on the surface and also use underwater entrances to hunt for food in the aquatic vegetation. Larvae are slow growing and the larval stage may last up to 10 years (DECC 2007).	**Unlikely** – no suitable habitat in the subject site
Fish				
Australian Grayling ***Prototroctes maraena***	E	V	On mainland Australia, this species has been recorded from rivers flowing East and South of the main dividing ranges. Grayling migrate between freshwater streams and the ocean and as such it is generally accepted to be a diadromous (migratory between fresh and salt waters) species. This species has been described as a microphagic carnivore that feeds principally on small crustaceans, algae and small insects (aquatic insect larvae and terrestrial insects) (DEH Species Profile 2006). The Shoalhaven River was formerly the most northern permanent habitat for Australian grayling. However, recent surveys have collected only a single specimen from the Shoalhaven system downstream of Tallowa Dam (Coysh et al. 2005 p. 34). This species is not known from the Minnamurra catchment	**Unlikely** – limited suitable habitat in the subject site, not recorded in catchment.
Macquarie Perch ***Macquaria australasica***	E	E	They are found in the Murray-Darling Basin (particularly upstream reaches) and parts of south-eastern coastal NSW, including the Hawkesbury and Shoalhaven catchments. Macquarie perch are found in both river and lake habitats, especially the upper reaches of rivers and their tributaries (DPI Primefact 2006). Quiet, furtive fish that feed on aquatic insects, crustaceans and molluscs. Populations of Macquarie perch in the Shoalhaven and Hawkesbury River systems possibly constitute a separate species from fish in the Murray-Darling River system (Dufty, 1986; Harris and Rowland, 1996). However the known population of Macquarie Perch in the Mongarlowe River an upstream tributary of the Shoalhaven River is thought to be a translocated population of the Murray Darling sub-species (Faulks *et al* 2009). The Kangaroo River, or the original lower Shoalhaven River catchment population of Macquarie Perch is thought to be genetically separate possibly an unrecognised (albeit extinct) species (Faulks *et al* 2009). This species is not known from the Minnamurra catchment	**No**– limited suitable habitat in the subject site, not recorded in catchment.

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Amphibians				
Giant Burrowing Frog ***Heleioporus australiacus***	V	V	Occurs on sandy soils supporting heath, woodland or open forest vegetation types. This species requires the creeks and watercourses for breeding but during other times spends its time buried under deep leaf litter or sandy loose soil within vegetated areas. The Giant Burrowing Frog only comes out to feed and breed following rainfall and is therefore difficult to detect at other times. Breeding takes place from August to March (DECC 2006f). The Giant Burrowing Frog is a large, squat, slow-moving frog that grows to about 10 cm long. It has prominent, large eyes and has dark chocolate-brown upperparts with white or yellow spots on the side. The Giant Burrowing Frog occurs from the NSW Central Coast to eastern Victoria, but is most common on the Sydney sandstone. It has been found from the coast to the Great Dividing Range. This frog is found in heath, woodland and open forest with sandy soils and generally lives in the heath or forest and will travel several hundred metres to creeks to breed. It burrows into deep litter or loose soil, emerging to feed or breed after rain feeding on ground-dwelling invertebrates such as ants, beetles and spiders (DEC Species Profiles)	**No**. No suitable habitat exists in the study area.
Red-crowned Toadlet ***Pseudophryne australis***	V	-	Occurs in open forests, mostly on Hawkesbury and Narrabeen Sandstones. It inhabits periodically wet drainage lines below sandstone ridges that often have shale lenses or cappings, sheltering under rocks and amongst masses of dense vegetation or thick piles of leaf litter. Breeding congregations occur in dense vegetation and debris beside ephemeral creeks and gutters, and eggs are laid in moist leaf litter, from where they are washed by heavy rain. This species will disperse outside the breeding period, when they are found under rocks and logs on sandstone ridges and forage amongst leaf-litter (DECC 2006g).	**No**. No suitable habitat exists in the study area. Outside known range of the species. .
Green and Golden Bell Frog ***Litoria aurea***	E	V	The Green and Golden Bell Frog is a relatively large frog which inhabits a variety of freshwater habitats including marshes, swamps, lagoons, farm dams and ornamental ponds (Cogger 2000). Optimum habitat usually contains macrophyte cover (e.g bull rushes Typha spp. or spikerushes *Eleocharis* spp.) for diurnal sheltering with nearby grassed areas and an unshaded waterbody free of predatory fish *Gambusia holbrooki* (Pyke and White 1996). The species is largely aquatic and known to breed from September to early April (personal observations) but most commonly during the summer months (Pyke and White 2001). There is no known population of Green and Golden Bell Frogs occurring on the subject site or study area.	**No**. No suitable habitat exists in the study area. Not recorded during targeted surveys
Littlejohn's Tree Frog ***Litoria littlejohni***	V	V	The frog is found in permanent rocky streams with thick fringing vegetation associated with eucalypt woodlands and heaths among sandstone outcrops. Distribution limit- plateaus and eastern slopes of the Great Dividing Range from Watagan State Forest (90 km north of Sydney) south to Buchan in Victoria. It occurs along permanent rocky streams with thick fringing vegetation associated with eucalypt woodlands and heaths among sandstone outcrops. It hunts either in shrubs or on the ground (DEC Species Profile 2006).	**No**. No suitable habitat exists in the study area. No local records. Not recorded during surveys

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Stuttering Frog ***Mixophyes balbus***	E	V	This species is a large muscular frog that occurs along the east coast of Australia. They are found in rainforest and wet, tall, open forest. When not breeding, adults live in deep leaf litter and thick understorey vegetation on the forest floor. This species feeds on insects and smaller frogs, breeding in streams during summer after heavy rain. Threats include modification and loss of habitat, changes to hydrology and water quality, predation of eggs and tadpoles by introduced fish, and fungal disease (DEC 2007).	**No**. Very little suitable habitat exists in the study area. No local records. Not recorded during surveys
Reptiles				
Green Turtle ***Chelonia mydas***	V	V	The Green Turtle has an olive green, nearly circular or heart-shaped carapace (upper shell) of up to 1 m in length. The carapace is usually variegated with brown, reddish-brown and black on the top and whitish or cream underneath. There are four pairs of costal shields (shell plates located on either side of the mid-line) between the centre and outer margin of the upper shell (Cogger 2000; Limpus 1995a). Green turtles occur in seaweed-rich coral reefs and inshore seagrass pastures in tropical and subtropical areas of the Indo-Pacific region. The single record within 10km of the subject area was from a Taronga Zoo record near Nowra in the Shoalhaven River and most likely a transient individual.	**No –** Marine species.
Loggerhead Turtle ***Caretta caretta***	E	E	The Loggerhead Turtle is a marine reptile that occurs from north-east New South Wales to Queensland, the Northern Territory and south to Shark Bay in Western Australia. In Australia, the species breeds in the south-east.	**No –** Marine species.
Leatherback Turtle ***Dermochelys coriacea***	V	V	The Leatherback Turtle or Leathery Turtle Dermochelys coriacea (Vandelli, 1761) is the largest of the marine turtles, ranging from 1.50-1.74 m (curved carapace length for females), and weighing around 200-300 kg (Hamann et al. 2006; Wells 2007). The Leatherback Turtle has a worldwide distribution in tropical and temperate oceans with a number of widely separated and therefore distinct breeding stocks (Limpus 2009). The geographic range of the species is considered the largest of all living marine reptiles (Benson et al. 2007). The main nesting beaches for the Leatherback Turtle are located in tropical and subtropical areas outside of Australia (e.g. Java, Papua New Guinea, Solomon Islands, Vanuatu) (Wells 2007). There is no evidence that Australia has ever supported a large nesting population of Leatherback Turtles (Limpus 2006),	**No –** Marine species.
Hawksbill Turtle ***Eretmochelys imbricata***		V	Hawksbills typically occur in tidal and sub-tidal coral and rocky reef habitats throughout tropical waters, extending into warm temperate areas as far south as northern New South Wales. In Australia the main feeding area extends along the east coast, including the Great Barrier Reef. Other feeding areas include Torres Strait and the archipelagos of the Northern Territory and Western Australia, possibly as far south as Shark Bay or beyond.	**No –** Marine species.
Broad-headed Snake (***Hoplocephalus bungaroides***)	E	V	This species is nocturnal, sheltering in rock crevices and under flat sandstone rocks on exposed cliff edges during autumn, winter and spring, moving to shelters in hollows in large trees within 200 m of escarpments in summer. The Broad-headed Snake feeds mostly on geckos and small skinks, as well as occasionally frogs and small mammals (DECC 2006u).	**No**. Suitable rocky habitat does not exist.

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			A black snake with yellow scales forming narrow crossbands, it is found under large slabs or rocky ridges or in rocky crevices, largely confined to the Hawkesbury sandstone formation (Cogger 1992).	
Rosenberg's Goanna ***Varanus rosenbergi***	V	-	This species is found in heath, open forest and woodland. This species is associated with termites, the mounds of which it nests in. Termite mounds are a critical habitat component. Rosenberg's Goanna feeds on carrion, birds, eggs, reptiles and small mammals. It will shelter in hollow logs, rock crevices and in burrows, which they may dig for themselves, or they may use other species' burrows, such as rabbit warrens (DECC 2006v).	**No**. Suitable habitat does not exist.
Avifauna				
Freckled Duck ***Stictonetta naevosa***	V		Freshwater swamps or creeks with a dense growth of Cumbungi, Lignum or Tea-tree. Dependent on permanent water to provide algae which is the principle food. Diet also includes insects and crustaceans. Nomadic species moving between ephemeral inland wetlands to permanent inland or coastal wetlands during drier years (Garnett & Crowley 2000).	**No**. No suitable large permanent water habitat exists in the study area.
Blue-billed Duck ***Oxyura australis***	V		Inhabits deep permanent lakes and swamps, rarely on small farm dams. Feeds on midge and stonefly larvae and plant matter. Mainly recorded west of the ranges in the Murray and Riverina areas.	**No**. No suitable open water habitat exists in the study area.
Wandering Albatross ***Diomedea exulans***	E	V	The Wandering Albatross visits Australian waters extending from Fremantle, Western Australia, across the southern water to the Whitsunday Islands in Queensland between June and September. It has been recorded along the length of the NSW coast. At other times birds roam the southern oceans and commonly follow fishing vessels for several days.	**No** – Marine pelagic species
Black-necked Stork ***Ephippiorhynchus asiaticus***	E		Found in swamps, mangroves and mudflats. Can also occur in dry floodplains and irrigated lands and occasionally forages in open grassy woodland. Nests in live or dead trees usually near water (Pizzey and Knight 1997).	**No**. No suitable wetland habitat exists in the study area.
Cattle Egret ***Ardea ibis***		M	This species of Migratory bird occurs in grasslands, woodlands, wetlands and pasture areas often seen with cattle and other animals. It makes shallow platform nests in wetland areas in surrounding trees and shrubs. They feed on grasshoppers and other invertebrates, frogs, lizards, and small mammals.	**Yes**. No suitable open grassland/woodland /wetlands habitat exists in the study area.
Great Egret / White Egret ***Ardea alba***		M	This species of wetland bird occurs in a variety of habitats including marshes, swamps, river margins, lake shorelines, flooded grasslands, sea-grass flats, mangrove swamps, coastal lagoons, and offshore coral reefs. Feeds in shallow to moderately deep water, on shore next to the water, or on dry ground primarily on fish, insects and shrimp. Other foods include frogs, lizards, snakes, small mammals, and small birds. Breeding occurs in early spring and summer, nesting in trees, bushes, bamboo, reeds and other plants near water and on islands.	**Possible**. Limited suitable open grassland/creekline habitat exists in the study area.

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Black Bittern ***Ixobrychus flavicollis***	V		Terrestrial and estuarine wetlands, generally in areas of permanent water and dense vegetation at the edges of watercourses, including swamps, billabongs, mudflats and mangroves. Where permanent water is present, the species may occur in flooded grassland, forest, woodland, rainforest or mangroves. Forages largely on fish and freshwater crayfish (Marchant & Higgins 1990).	**Unlikely**. No suitable open wetland habitat exists in the study area.
Australasian Bittern ***Botaurus poiciloptilus***	V		Australasian Bitterns are widespread but uncommon over south-eastern Australia. Favours permanent freshwater wetlands with tall, dense vegetation, particularly bullrushes (Typha spp.) and spikerushes (Eleoacharis spp.).Hides during the day amongst dense reeds or rushes and feeds mainly at night on frogs, fish, yabbies, spiders, insects and snails 9DEC Species Profile 2006).	**Unlikely**. No suitable open wetland habitat exists in the study area.
Square-tailed Kite ***Lophoictinia isura***	V		Widely distributed throughout NSW but concentrated on the coast and inland slopes of the Great Dividing Range. Occurs in drier open forests and woodlands including Spotted Gum Forest and Box-Ironbark woodland. Specialised predator of nestling passerines. Nesting birds require mature eucalypt near a rich source of nesting birds and pairs often nest in the same tree for many years. Pairs occupy large territories over 100km^2 (Garnett & Crowley 2000).	**Possible –** recorded locally. Limited potential habitat is present along Hyams Creek
Osprey ***Pandion haliaetus***	V	M	This species is a large, water-dependent bird of prey, distinctive in flight and when perched. Despite its wing-span of up to 1.7 m, it is noticeably smaller than the White-bellied Sea-eagle. It favours coastal areas, especially the mouths of large rivers, lagoons and lakes. They feed on fish over clear, open water. Breeding takes place from July to September in NSW, with nests being built high up in dead trees or in dead crowns of live trees, usually within one kilometre of the sea. Threats include the removal of large trees near the coast, diminished water quality that increases turbidity in feeding areas, and the ingestion of fish containing discarded fishing tackle (DEC 2007).	**Unlikely** to occur in the subject site but would occur in the region and locality, however, suitable open fishing habitat for this species is absent in the study area. Potential nesting habitat in the form of large trees is absent.. Not recorded during the surveys of the study area.
White-bellied Sea Eagle **Haliaeetus leucogaster**		M	This species of large bird occurs along the coastline of Australia and also range inland over large rivers and wetlands, favouring forested coasts and forested margins of inland waterways. Nests are usually near water, in tall live or dead trees or on remote coastal cliffs. River Red Gum (*Eucalyptus camaldulensis*), Forest Red Gum (*E. tereticornis*) and Southern Mahogany (*E. botryoides*) are commonly used as nest trees (Emison & Bilney 1982). On islands free of predators, nests may be close to the ground in shrubs or rocky platforms (Marchant & Higgins 1993).	**Unlikely**. Very little suitable habitat not recorded in study area. Not recorded during the survey period.
Little Eagle ***Hieraaetus morphnoides***	V		The Little Eagle occupies habitats rich in prey within open eucalypt forest, woodland or open woodland. She-oak or acacia woodlands and riparian woodlands of interior NSW are also used (Marchant and Higgins 1993; Aumann 2001a). For nest sites it requires a tall living tree within a remnant patch, where pairs build a large stick nest in winter and lay in early spring. Young fledge in early summer. Generation length has been estimated as 10 years (Debus and Soderquist 2008). It eats birds, reptiles and mammals, occasionally adding large insects and carrion (Marchant and Higgins 1993; Aumann 2001b; Debus et al. 2007). It was formerly heavily dependent on rabbits, but following the spread of rabbit calicivirus disease, and consequent decline in rabbit numbers by 65-85% in the arid and semi-arid zones (Sharp et al. 2002), the Little Eagle	**Possible –** limited foraging habitat present along Hyams Creek

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			is increasingly dependent on native prey. Most of its former native mammalian prey species in inland NSW are extinct (terrestrial mammals of rabbit size or smaller, e.g. large rodents, bandicoots, bettongs, juvenile hare-wallabies and wallabies: Van Dyck and Strahan 2008). The Little Eagle is distributed throughout the Australian mainland excepting the most densely forested parts of the Dividing Range escarpment (Marchant and Higgins 1993). It occurs as a single population throughout NSW.	
Spotted Harrier ***Circus assimilis***	V		The Spotted Harrier occurs in grassy open woodland including acacia and mallee remnants, inland riparian woodland, grassland and shrub steppe (e.g. chenopods) (Marchant and Higgins 1993; Aumann 2001a). It is found most commonly in native grassland, but also occurs in agricultural land, foraging over open habitats including edges of inland wetlands. The species builds a stick nest in a tree and lays eggs in spring (or sometimes autumn), with young remaining in the nest for several months. Generation length is estimated as 10 years (Debus and Soderquist 2008). The diet of the Spotted Harrier includes terrestrial mammals, (e.g. bandicoots, bettongs and rodents: Van Dyck and Strahan 2008) birds and reptiles, occasionally large insects and rarely carrion (Marchant and Higgins 1993; Aumann 2001b). The Spotted Harrier occurs throughout the Australian mainland, except in densely forested or wooded habitats of the coast, escarpment and ranges, and rarely in Tasmania (Barrett *et al.* 2003). Individuals disperse widely in NSW and comprise a single population.	**Possible –** limited foraging habitat present along Hyams Creek
Bush Stone-curlew ***Burhinus grallarius***	E		This species inhabits open forests and woodlands with a sparse grassy ground layer and fallen timber. Largely nocturnal, being especially active on moonlit nights, it feed on insects and small vertebrates, such as frogs, lizards and snakes. Nests are on the ground in a scrape or small bare patch. Threats include predation by foxes and cats, trampling of eggs by cattle, clearance of woodland habitat through removal of litter and fallen timber, introduction of exotic pasture grasses, grazing and frequent fires, and other disturbance in the vicinity of nest sites (DEC 2007).	**Unlikely**. Very little suitable habitat not recorded in study area. Not recorded during the survey period.
Comb-crested Jacana ***Irediparra gallinacea***	V		Occurs in freshwater wetlands, lagoons, Billabongs, swamps, lakes, rivers and reservoirs, generally with abundant floating aquatic vegetation (Marchant and Higgins 1993).	**No**. No suitable wetland habitat exists in the study area.
Australian Painted Snipe ***Rostralula australis***	E	V	The Painted Snipe is a medium-sized waterbird of 24-30 cm in length and wingspan of 50-54 cm. The species inhabits shallow freshwater wetlands, vegetated ephemeral and permanent lakes and swamps, and inundated grasslands.	**Unlikely**. No suitable wetland habitat exists in the study area.
Hooded Plover ***Thinornis rubicollis***	CE	V	The Hooded Plover Thinornis rubricollis (Gmelin, 1789) is a small (21 cm) grey-brown shorebird with a black head, white collar and underparts, red bill and eye-ring, and orange legs. The Hooded Plover occurs around the southern coast of Australia and Tasmania, and on inland saline wetlands in south-west Western Australia (Marchant & Higgins 1993). It is restricted to the littoral zone of beaches and	**No**. No suitable beach side habitat exists in the study area.

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			sandy estuaries, where it nests on the ground just above the tideline. In NSW, the Hooded Plover historically occurred north to at least the Sydney region, and possibly to Port Stephens. Resident birds are now found only south of Wollongong. Its current northern breeding limit is around Shoalhaven Heads. NSW birds constitute a single population, having possible dispersal and genetic interchange across the NSW-Victorian border.	
Superb Fruit Dove ***Ptilinopus superbus***	V		The Superb Fruit Dove's NSW distribution ranges from northern NSW to as far south as Moruya (DEC 2005). It is found in rainforests, closed forests (including mesophyll vine forests) and sometimes in eucalypt and acacia woodlands where there are fruit-bearing trees (Higgins and Davies 1996). It forages in the canopy of fruiting trees such as figs and palms. Nests are constructed high in the canopy throughout September to January (DEC 2005).	**Possible –** limited foraging habitat present along Hyams Creek
Glossy Black-Cockatoo ***Calyptorhynchus lathami***	V		Highly specialised species feeding almost exclusively on the seeds extracted from the wooden cones of *Allocasuarina* species including Black She-oak (*Allocasuarina littoralis*), Forest She-oak (*Allocasuarina torulosa*) or Drooping She-oak (*Allocasuarina verticillata*). This species needs suitable hollows in living and dead trees for nesting and breeds between March and August (DECC 2006h).	**No.** Preferred habitat absent from the study area.
Gang-gang Cockatoo ***Callocephalon fimbriatum***	V	-	This species is nomadic and spends summer in tall mountain forests and woodlands, particularly in heavily timbered and mature wet sclerophyll forests. It spends winter at lower altitudes in drier more open eucalypt forests and woodlands particularly in coastal areas. This species nests in hollow-bearing trees close to water with breeding taking place between October and January. Breeding usually occurs in tall mature sclerophyll forests that have a dense understorey, and occasionally in coastal forests (DECC 2006i). It feeds on a wide variety of seeds and berries, from both native (eucalypts, wattles and casuarinas) and introduced plant species (such as Hawthorn). In some areas (such as the Ku-ring-gai and Hornsby LGAs), specific eucalypt species and casuarina seed are its primary food source (DECC 2004d; McGrath 1997). The Gang-gang utilises large hollows in the trunk or limbs of living or dead eucalypt trees for nesting (Garnett et al. 1999). Hollows of sufficient size for nesting generally do not form in eucalypt trees less than 150 - 200 years old (Mackowski 1984). Gang-gang Cockatoos feed mainly on the fruits of eucalypts and acacias but will feed on other seeds and fruit such as Callitris (as observed nearby the study area), garden fruits, hawthorn and Callistemon as well as some insects and their larvae.	**No.** Preferred habitat absent from the study area.
Little Lorikeet ***Glossopsitta pusilla***	V		The Little Lorikeet Glossopsitta pusilla (Shaw, 1790) is an endemic Australian parrot measuring 16–19 cm in length and weighing approximately 40 g. It is the smallest of the Australian Lorikeets. The body is bright green in colour and the head is green with red forehead and throat patches that do not extend behind the eye. The distribution of the Little Lorikeet extends from just north of Cairns, around the east coast of Australia, to Adelaide. In New South Wales Little Lorikeets are distributed in forests and woodlands from the coast to the western slopes of the Great Dividing Range, extending westwards to the vicinity of Albury, Parkes, Dubbo and Narrabri (Barrett et al. 2003).	**Possible**. Limited foraging habitat for this species is present along Hyams Creek. Not recorded during targeted surveys of the study.

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			There is no evidence of regular migration, but Little Lorikeets are generally considered to be nomadic (Higgins 1999), with irregular large or small influxes of individuals occurring at any time of year, apparently related to food availability. They feed primarily on nectar and pollen in the tree canopy, particularly on profusely-flowering eucalypts, but also on a variety of other species including, melaleucas and mistletoes. The breeding season extends from May to September (Higgins 1999) and as long as eucalypt nectar and pollen are available throughout this period, two broods of fledglings can be raised in a season.	
Swift Parrot ***Lathamus discolor***	E	E	This species is migratory, travelling from Tasmania to the mainland from March to October to forage on winter flowering eucalypts and lerps. While on the mainland, it mostly occurs in the southeast, with records of the species spread approximately between Adelaide and Brisbane. Breeding takes place in Tasmania from September to January. Fragmentation and land clearing for agricultural, urban, and coastal development has resulted in the restriction of the range and distribution of the species (DEC 2007) Diet consists largely of flowering Eucalypts, including Swamp Mahogany, Spotted Gum and Narrow-leaved ironbark in the western Sydney region (NPWS 1997). On the mainland, they occur in areas where eucalypts are flowering profusely or where there are abundant lerp infestations. There are no local records of the Swift Parrot in the Nowra area and it appears that the migration does not occur through the locality	**Unlikely**. No suitable habitat. Not recorded in subject site or locally.
Orange-bellied Parrot ***Neophema chrysogaster***	CE	CE	The Orange-bellied Parrot, Neophema chrysogaster slim parrot (length 22-25 cm), grass-green above and yellowish below. Adult male has a prominent, two-tone blue frontal band, green-blue uppertail with yellow sides that are conspicuous in flight, orange patch on belly. Adult female similar but slightly duller, orange patch slightly smaller and tail greener. It is a coastal species inhabiting saltmarshes, sedge plains, coastal dunes, pastures, shrublands and moorlands, generally within 10 km of the coast (OBPRT 1998). A single breeding population of fewer than 200 individuals occurs in a narrow coastal strip of south-west Tasmania between Birch's Inlet in Macquarie Harbour and Louisa Bay. Most pairs breed in the forested margins of coastal sedge plains and in patches of eucalypt within moorland areas. Adult birds depart Tasmania for the mainland in February/March. The winter distribution is patchy, with up to 70% of the mainland population concentrated in three wintering sites around Port Phillip Bay and the Bellarine Peninsula (the Murtcaim Wildlife Area, Lake Connewarre and Swan Bay). Historical records indicate that the Orange-bellied Parrot was formerly more abundant and widespread than it is now, ranging as far north as Sydney, NSW (McGill 1960). A recent sighting was made near Nowra in 1986 and two consecutive sightings of a banded juvenile (possibly the same bird) were made in 2003, first in Shellharbour, south of Wollongong, and again at Maroubra, south of Sydney (Starks 2004). These sightings indicate that the species' distribution continues to extend into south-eastern NSW where suitable habitat is still available.	**No**. No suitable habitat. Not recorded in subject site or locally for 30 years.

Common Name (Species Name)	TSC Act Status	EPBC Act Status	Habitat Association	Likelihood of Occurring in Study Area
Turquoise Parrot ***Neophema pulchella***	V	-	Open eucalypt woodlands and forests, typically with a grassy understorey. It favours the edges of woodlands adjoining grasslands or timbered creek lines and ridges. A granivorous species, the Turquoise Parrot feeds on the seeds of native and introduced grasses and other herbs. Grasslands and open areas provide important foraging habitat for this species while woodlands provide important roosting and breeding habitat for this species. This species nests in tree hollows, logs or posts from August to December (DECC 2006l).	**Unlikely**. Very little suitable habitat not recorded in study area. Not recorded during the survey period.
Eastern Ground Parrot ***Pezoporus wallicus***	V		Mainly found in heathland, sedgeland or buttongrass plains providing medium to dense cover (Higgins 1999). Population occurs to the west in Barren Grounds Nature Reserve	**No.** Preferred habitat absent from the study area.
Powerful Owl ***Ninox strenua***	V	-	This species occurs in a number of vegetation types ranging from woodland and open sclerophyll forest to tall open wet forest and rainforest. However, this species does prefer large tracts of vegetation. Powerful Owls nest in large tree hollows (at least 0.5 m deep), in large eucalypts (diameter at breast height of 80-240 cm) that are at least 150 years old with breeding taking place from late-summer to late-autumn. Pairs of Powerful Owls are believed to have high fidelity to a small number of hollow-bearing nest trees and will defend a large home range of 400 – 1,450 ha. It forages within open and closed woodlands as well as open areas (DECC 2006m). The Powerful Owl inhabits a large home range (>1000ha) in vegetation types ranging from woodland and open forest to moist forest and rainforest. Eucalypt forests of northeastern NSW, which provide a stronghold for the species. Nests are in large tree-hollows (at least 50cm deep) in mature eucalypts. Adult birds have strong nesting site fidelity and remain in one large home range throughout their life. Primary prey includes medium-sized arboreal mammals (eg. Greater Gliders, Ringtail Possums, Sugar Gliders and flying-foxes).	**Unlikely.** Preferred habitat absent from the study area.
Barking Owl ***Ninox connivens***	V		This species is a typical hawk-owl, with staring yellow eyes, and no facial disc. It has an unmistakeable, quick, dog-like "wook-wook" territorial call, which it repeats. It inhabits eucalypt woodlands, open forest, swamp woodlands, and, especially in inland areas, timber along watercourses. During the day they roost along creek lines, usually in tall understorey trees with dense foliage such as Acacia and Casuarina species, or in dense clumps of canopy leaves in large eucalypts. The Barking owl feeds on a variety of prey, with invertebrates predominant for most pf the year, and birds and mammals such as smaller gliders, possums, rodents and rabbits important during breeding. This species lives alone or in a pair with territories ranging from 30 to 200 hectares. Nests are built in hollows of large, old eucalypts including River Red Gum (Eucalyptus camandulensis), White Box (Eucalyptus albens), Red Box (Eucalyptus polyanthemos), and Blakely's Red Gum (Eucalyptus blakelyi). Breeding occurs during late winter and early spring (DEC 2007).	**Unlikely.** Preferred habitat absent from the study area.
Sooty Owl ***Tyto tenebricosa***	V	-	This species inhabits rainforest and moist eucalypt forest and roosts in dense vegetation and nests in very large tree-hollows (DECC 2006o). Occurs in rainforest, including dry rainforest, subtropical and warm temperate rainforest, as well as moist eucalypt forests. Roosts by day in the hollow of a tall forest tree or in heavy vegetation; hunts by night for small ground mammals or tree-dwelling mammals. Nests in very large tree-hollows (DEC 2007).	**Unlikely.** Preferred habitat absent from the study area.

Common Name (Species Name)	TSC Act Status	EPBC Act Status	Habitat Association	Likelihood of Occurring in Study Area
Masked Owl ***Tyto novaehollandiae***	V	-	Occurs in dry eucalypt woodlands at altitudes from sea level to 1,100 m and roosts and breeds in hollows and sometime caves in moist eucalypt forested gullies. This species hunts along the edges of forests and roadsides and has a home range covering between 500 ha and 1 000 ha (DECC 2006n).	**Unlikely.** Preferred habitat absent from the study area. .
Fork-tailed Swift ***Apus pacificus***		M	This species of migratory bird breeds in the north-east and mid-east Asia and over-winters in Australia and southern New Guinea from October. It forages over open country and nests in cliffs and tall tress. Occasional mass movements occur and this species may spend nights on the wing (Pizzey and Knight 2003).	**Possible.** Migrating species which may use the subject site during the summer months
White-throated Needletail ***Hirundapus caudacutus***		M	This species of migratory bird migrates from Siberia, the Himalayas, and Japan to Australia in Summer, arriving mid-October and departing mid-April. It is known to inhabit a variety of habitats including forests, woodlands, farmlands, plains, lakes, costs and towns (Pizzey and Knight 1999). The White-throated Needletail nests in tree hollows and feeds on insects during flight, chiefly ahead of weather changes. In Australia this species is nomadic, responding to local weather changes (Readers Digest 1993).	**Possible.** Migrating species which may use the subject site during the summer months
Rainbow Bee-eater ***Merops ornatus***		M	This species of small bird occurs in a variety of habitat but seems to prefer open forests and woodlands, shrublands, and various cleared or semi-cleared habitats, including farmland and areas of human habitation often located close to permanent water. It also occurs in inland and coastal sand dune systems, and in mangroves in northern Australia, and has been recorded in heathland, sedgeland, vine forest and vine thicket, and on beaches. Breeding occurs from August to January, nesting in enlarged chambers at the end of long burrow or tunnel excavated by both sexes in flat or sloping ground, in the banks of rivers, creeks or dams, in roadside cuttings, in the walls of gravel pits or quarries, in mounds of gravel, or in cliff-faces. Nest sites are often re-used. This species primarily feeds on insects including bees, wasps, beetles, moths, butterflies, damselflies, dragonflies, flies, ants and bugs, and will occasionally eat earthworms, spiders and tadpoles. This species migrates north for the winter months within Australia after breeding has occurred. Threats include predation of nests by other animals, and nest destruction by flooding or trampling (DPI 2007).	**Possible.** Migrating species which may use the subject site for foraging only.
Eastern Bristlebird ***Dasyornis brachypterus***	E	V	The Eastern Bristlebird is a passerine bird approximately 200 millimetres in length, weighing 40 grams. It is terrestrial, camouflaged, shy and cryptic. It is capable of only very short flights. The species is generally detected singly or in pairs at densities up to 25 birds per 100 hectares. Inhabits coastal woodland, dense scrub and heath, often near taller forest in now a confined three disjoint areas of south-eastern Australia: the NSW/Queensland border region; the Illawarra region and the NSW/Victorian border region. The total population is estimated at less than 2000 individual birds. The evidence from recent surveys is that the total population has declined. The northern populations declined by approximately 50% between 1989 and 1992. Only two populations, both within the Illawarra region, are likely to exceed 500 birds. These populations occur on the Budderoo Plateau and the Bherwerre Peninsula.	**No.** Preferred habitat absent from the study area. Only one local record.

Common Name (Species Name)	TSC Act Status	EPBC Act Status	Habitat Association	Likelihood of Occurring in Study Area
Regent Honeyeater ***Anthochaera phrygia***	E	E	Inhabits dry open forest and woodland, particularly Box-Ironbark woodland, and riparian forests of River She-oak where there are significantly large numbers of mature trees, high canopy cover and abundance of mistletoes. Every few years non-breeding flocks are seen foraging in flowering coastal Swamp Mahogany and Spotted Gum forests, particularly on the central coast and occasionally on the upper north coast (DECC 2006p). This species inhabits wet eucalypt woodland and open forest, including wooded parts of cleared areas, in northeastern Vic and west of the Great Dividing Range in NSW. Also, occurs on the central coast of NSW (Garnett 1992a). Feeds on nectar of Eucalypts, and insects.	**No.** Preferred habitat absent from the study area.
White-fronted Chat ***Epthianura albifrons***	V		The White-fronted Chat Epthianura albifrons (Jardine & Selby, 1828) is an endemic Australian passerine bird, measuring 12 cm in length and weighing approximately 13 g. It has a short slender bill, long spindly legs, a short square-tipped tail and rounded wings (Higgins et al. 2001). Found in estuarine and marshy and damp open grassland habitats on the coast and open grassy plains, saltlakes and saltpans that are along the margins of rivers and waterways in inland areas. The distribution of the White-fronted Chat extends across the southern half of Australia, from the southernmost areas of Queensland to southern Tasmania and across to Western Australia as far north as Carnarvon (Barrett et al. 2003). During the breeding (Spring-summer) season they form simple monogamous pairs, but will join small flocks to feed and roost. They are insectivorous, with flies and beetles being the major components of their diet, feeding from the ground or catching flying insects close to the ground (Major 1991a).	**Unlikely.** Preferred habitat absent from the study area.
Flame Robin ***Petroica phoenicea***	V		The Flame Robin *Petroica phoenicea* Gould 1837 is a small (14 cm) songbird with dark grey upperparts, orange-red underparts from chin to belly, a small white forehead spot, and white flashes in the wings and tail. The Flame Robin is found in south-eastern Australia (Queensland border to Tasmania, western Victoria and south-east South Australia). In NSW it breeds in upland moist eucalypt forests and woodlands, often on ridges and slopes, in areas of open understorey. It migrates in winter to more open lowland habitats such as grassland with scattered trees and open woodland on the inland slopes and plains (Higgins and Peter 2002). There may be two disjunct breeding populations in NSW on the Northern Tablelands and the Central–Southern Tablelands (inferred from distributional data in Barrett et al. 2003 and the NSW Wildlife Atlas).	**Unlikely.** Preferred habitat absent from the study area.
Scarlet Robin ***Peterocia boodang***	V		The Scarlet Robin Petroica boodang (Lesson 1838) is a small (13 cm) songbird with black upperparts and chin, red breast, white lower belly, a large white forehead spot, and white flashes in the wings and tail. The Scarlet Robin is found in south-eastern Australia (extreme south-east Queensland to Tasmania, western Victoria and south-east South Australia) and south-west Western Australia. In NSW it occupies open forests and woodlands from the coast to the inland slopes (Higgins and Peter 2002). Some dispersing birds may appear in autumn or winter on the eastern fringe of the inland plains. The Scarlet Robin breeds in drier eucalypt forests and temperate woodlands, often on ridges and slopes, within an open understorey of shrubs and grasses	**Unlikely.** Preferred habitat absent from the study area.

Common Name (Species Name)	TSC Act Status	EPBC Act Status	Habitat Association	Likelihood of Occurring in Study Area
			and sometimes in open areas. Abundant logs and coarse woody debris are important structural components of its habitat. In autumn and winter it migrates to more open habitats such as grassy open woodland or paddocks with scattered trees. It forages from low perches, feeding on invertebrates taken from the ground, tree trunks, logs and other coarse woody debris.	
Pink Robin ***Petroica rodinogaster***	V		The Pink Robin is a small tubby bird, and is easily over-looked, being quieter than other robins. Males are brownish-black above, with a black throat and head. There is a small white spot above the bill, which is a buff spot on the female. Males have a diagnostic pink wash on the breast which extends right down under the belly. Females are a warm olive-brown above, with cinnamon buff underparts with a pinkish tint. Females and young birds have diagnostic buff wing patches. This species has a plain dark tail, lacking the white edges of other Petroica robins. In the breeding season (September to March) Pink Robins are seen singly or in pairs in deep gullies in dense shrub layers of damp and wet forests or rainforests. In winter, they are found in more open and drier habitats. Pink Robins breed in moist rainforest and may nest twice each season.	**Possible** – Suitable foraging and roosting habitat exists.
Varied Sittella ***Daphoenositta chrysoptera***	V		The Varied Sittella is a small (10 cm) songbird with a sharp, slightly upturned bill, short tail, barred undertail, and yellow eyes and feet. In flight the orange wing-bar and white rump are prominent. In NSW most birds have a grey head and are streaked with dark brown. Prefers open eucalypt woodlands and forests, mallee, inland acacia, coastal tee-tree scrubs, parks and gardens. The Varied Sittella is sedentary and inhabits most of mainland Australia except the treeless deserts and open grasslands, with a nearly continuous distribution in NSW from the coast to the far west (Higgins and Peter 2002; Barrett et al. 2003). It inhabits eucalypt forests and woodlands, especially rough-barked species and mature smooth-barked gums with dead branches, mallee and Acacia woodland. It builds a cup-shaped nest of plant fibres and cobweb in an upright tree fork high in the living tree canopy, and often re-uses the same fork or tree in successive years Large living and dead trees, particularly rough-barked eucalypts, which are essential for foraging, roosting and nesting sites.	**Unlikely.** Preferred habitat absent from the study area.
Olive Whistler ***Pachycephala olivacea***	V		Tall wet forest, woodlands and alpine heaths. Distributional Limits N - N-Border Ranges National Park S-South of Eden. The Olive Whistler is a small, stocky bird with a large head and strong sharp bill. It grows up to 22 cm long, including the 10 cm tail. It has a dark grey head, olive-brown upperparts, a grey throat and buff-brown underparts. The female is duller in colour than the male. The Olive Whistler has perhaps the most rich and melodious array of calls of any of the whistlers. The Olive Whistler inhabits the wet forests on the ranges of the east coast mostly above 500m. During the winter months they may move to lower altitudes. It has a disjunct distribution in NSW chiefly occupying the beech forests around Barrington Tops and the MacPherson Ranges in the north and wet forests from Illawarra south to Victoria. In the south it is found inland to the Snowy Mountains and the	**Unlikely.** Preferred habitat absent from the study area.

Common Name (Species Name)	TSC Act Status	EPBC Act Status	Habitat Association	Likelihood of Occurring in Study Area
			Brindabella Range. It forages in trees and shrubs and on the ground, feeding on berries and insects, making a nest of twigs and grass in low forks of shrubs. (DECC 2007).	
Black-faced Monarch ***Monarcha melanopsis***		M	This species of bird usually inhabits dense gullies of rainforest, sclerophyll forests and eucalypt woodlands along the coastal regions from Victoria to Cape York and is migratory over much of its range (Slater et al. 1989).	**Possible** – Suitable foraging and roosting habitat exists
Satin Flycatcher ***Myiagra cyanoleuca***		M	This is a migratory species which breeds around the Calliope Ranges in QLD southward to Tasmania during September / October to January / February before migrating north to southern and eastern Papua New Guinea and adjacent islands over winter. It prefers heavily vegetated gullies in forests, tall woodlands and during migration, coastal forests, woodlands, mangroves, trees in open country, and even gardens (Pizzey & Knight 1998).	**Possible** – Suitable foraging and roosting habitat exists
Rufous Fantail ***Rhipidura rufifrons***		M	This species is a breeding migrant to southeast Australia during July to December, wintering in Papua New Guinea. It prefers wetter eucalypt forests, gullies, coastal scrub, watercourses, and rainforests where it feeds on insects. Occasional reports have this species utilising parks and gardens during migration (Pizzey & Knight 1998).	**Possible** – Suitable foraging and roosting habitat exists
Bats				
Grey-headed Flying-fox ***Pteropus poliocephalus***	V	V	Grey-headed Flying Foxes roost in large camps which are commonly located in vegetation with a dense canopy in gullies in close proximity to water. The Grey-headed Flying-fox is endemic to Australia and primarily occurs along the east-coast of Australia from Bundaberg to Victoria. They are a highly mobile species whose migration patterns are determined by the availability of flowering food resources (Eby, 1991). The Grey-headed Flying-fox occurs in subtropical and temperate rainforests, tall sclerophyll forests and woodlands, heaths and swamps. During times when native food resources are limited, Grey-Headed Flying-foxes disperse from traditional roost sites and forage on fruit crops and cultivated gardens.	**Possible** – Suitable foraging and roosting habitat exists. Known camp 3 km to east.
Yellow-bellied Sheathtail-bat ***Saccolaimus flaviventris***	V		This species of insectivorous bat forages across a range of habitats including those with and without trees, from wet and dry sclerophyll forest, open woodland, Acacia shrubland, mallee, grasslands and desert. This species roosts in tree hollows and buildings and in areas where trees are scarce or absent, and has been known to utilise mammal burrows. Breeding takes place between December and mid-March. Threats include clearing of trees with hollows, grazing which reduces the regeneration of roost trees, pesticide and herbicide use, and predation by feral cats at roost sites (DEC 2007). Yellow-bellied Sheathtail bats occur in almost all habitats from wet and dry sclerophyll forest, open woodland, acacia shrubland, mallee, grasslands and desert (Churchill 1998). They forage in tree canopies and usually roost in tree hollows.	**Possible** – Suitable foraging and roosting habitat exists
Eastern Freetail-bat ***Mormopterus norfolkensis***	V		*M. norfolkensis* are found predominantly in dry eucalypt forest and woodland east of the Great Dividing Range. While this species is known to roost in tree hollows, under the bark of trees, under roofs and other manmade structures, little is known of the dietary preferences of the species (Churchill, 1998)..	**Possible** – Suitable foraging and roosting habitat exists

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Large-eared Pied Bat ***Chalinolobus dwyeri***	V	V	This species is distributed between south-eastern QLD to NSW from the coast to the western slopes of the divide. This species roosts in caves and mines and has been most commonly recorded from dry sclerophyll forests and woodlands. *C. dwyeri* is an insectivorous species that flies relatively slowly over the canopy or along creek beds (Churchill 1998). Threats include clearing and isolation of habitat, damage to roosting and maternal sites from mining operations, and recreational caving activities, and the use of pesticides (DEC 2007). *C. dwyeri* is most commonly recorded from dry sclerophyll forests and woodlands. They roost in caves and mines in colonies of 3 to 39 (Churchill 1990).	**Possible** – Suitable foraging and roosting habitat exists
Eastern False Pipistrelle ***Falsistrellus tasmaniensis***	V		This species inhabit sclerophyll forests and prefer wet habitats where trees are more than 20m high (Churchill 1989). They generally roost in hollow trunks of eucalypt trees. This species of bat inhabits moist forest generally with trees larger than 20 m and roosts in eucalypt hollows, underneath bark or in buildings. Diet consists of moths, beetles and other insects, which it collects within or just below the tree canopy. This species hibernates during winter and breeding takes place in late spring (DEC 2007).	**Possible** – Suitable foraging and roosting habitat exists
Eastern Bentwing-bat ***Miniopterus schreibersii oceanensis***	V	-	This species is essentially a cave-roosting bat, but is also known to utilise man-made habitats such as road culverts, storm-water tunnels and other man-made structures. It is known from a variety of habitats along the east coast including rainforest, wet and dry sclerophyll forest, monsoon forest, open woodland, paperbark forests and open grasslands (Churchill 1998, DECC 2006q). In forested areas, it flies above the canopy to hunt, while in open grassland areas, flight may be within six m of the ground. The Eastern Bent-wing rely on caves or similar artificial structures (such as mines and culverts) for roosting. This bat occupies a range of forested environments (including wet and dry sclerophyll forests), along the coastal portion of eastern Australia, and through the Northern Territory and Kimberley area (Churchill, 1998). This highly mobile species forages for insects above the tree canopy, and is capable of large regional movements in relation to seasonal differences in reproductive behaviour and winter hibernation (Gilmore & Parnaby, 1994).	**Possible.** Suitable foraging habitat exists.
Large-footed Myotis ***Myotis marcropus***	V		Distribution is mainly coastal, and roosting occurs in caves, mine tunnels, tree hollows or under buildings (Menkhorst & Knight 1995). Colonies are always located near water bodies. Forages for aquatic invertebrates and small fish over open water (including small creeks, pools and farm dams), catching prey with their feet. Also forage aerially (Richards 1995; Menkhorst & Knight 1995; Churchill 1998).	**Yes** – potential guano of this species recorded in Hyams Creek. Suitable habitat exists along Hyams Creek
Greater Broad-nosed Bat ***Scoteanax rueppllii***	V		The Greater Broad-nosed Bat has been recorded foraging in habitats ranging from rainforest to woodland and also throughout the ecotonal areas between forests and clearings (Churchill, 1998). The species prefers moist gullies in mature coastal forest or rainforest. The species feeds mainly on larger insects and beetles and can usually be observed flying slowly and directly at a height of 3 - 6 metres above the ground. It is believed to roost in tree hollows.	**Yes** – recorded. Suitable habitat exists along Hyams Creek

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Golden-tipped Bat ***Kerivoula papuensis***	V		The Golden-tipped Bat has dark brown, curly fur with bright golden tips. The distinctively coloured fur extends along the wings, legs and tail. It has a short, pointed, over-hanging muzzle and pointy, funnel-shaped ears. Found in rainforest and adjacent sclerophyll forest, this species roosts in abandoned hanging Yellow-throated Scrubwren and Brown Gerygone nests located in rainforest gullies on small first- and second-order streams. Will fly up to two km from roosts to forage in rainforest and sclerophyll forest on upper-slopes and is a specialist feeder on small web-building spiders (DECC 2007).	**Unlikely.** Very little dense gully forest foraging habitat exists. No scrub wren nests observed
Other Mammals				
Spotted-tailed Quoll ***Dasyurus maculatus***	E	E	Inhabits a range of environments including rainforest, open forest, woodland, coastal heath and inland riparian forest, from the sub-alpine zone to the coastline. Den sites are found in hollow-bearing trees, fallen logs, small caves, rock crevices, boulder fields and rocky-cliff faces. Females occupy home ranges of up to 750 ha and males up to 3,500 ha, which are usually traversed along densely vegetated creeklines (DECC species profile). The Spotted-tailed Quoll occupies a range of environments within a disjunct distribution along the east coast of Australia. Its distribution extends from south eastern Queensland through NSW and Victoria to Tasmania. Individual animals use hollow-bearing trees, fallen logs, small caves, rock crevices, boulder fields and rocky-cliff faces as den sites and feed on gliders, possums, small wallabies, rats, birds, bandicoots, rabbits and insects; also eats carrion and takes domestic fowl. Mostly nocturnal, although will hunt during the day; spends most of the time on the ground, although also an excellent climber and may raid possum and glider dens and prey on roosting birds. Use 'latrine sites', often on flat rocks among boulder fields and rocky cliff-faces; these may be visited by a number of individuals; latrine sites can be recognised by the accumulation of the sometimes characteristic 'twisty-shaped' faeces deposited by animals. Suitable foraging and/or shelter sites were limited across the study area.	**Possible**. Foraging habitat for this species is present throughout the study area. Not recorded during targeted surveys of the study.
White-footed Dunnart ***Sminthopsis Leucopus***	V		The White-footed Dunnart *Sminthopsis leucopus* is a small, nocturnal, carnivorous marsupial similar in size to the House Mouse, it occurs throughout Tasmania, across southern Victoria and south-eastern New South Wales with an outlier population occurring in north-eastern Queensland (Menkhorst & Knight 2001). Inhabits tussock grassland, sedgeland, scrub, heathland, woodlands and open forest with a heath understorey, using hollow logs and stumps for shelter. Both male and female White-footed Dunnarts are thought to have stable, undefended home ranges, with extensive overlap within and between sexes. Laidlaw et al. (1997) found the average home range to be around 0.9ha White-footed Dunnarts appear to have only one short breeding season during their lifetime (Menkhorst 1995).	**No –** Preferred habitat not present.

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Southern Brown Bandicoot ***Isoodon obesulus***	E	E	This marsupial inhabits scrubby vegetation, including heath, shrubland, and heathy forest and woodland. It is often associated with well-drained soils and dry heathland communities. The Southern brown Bandicoot is a nocturnal species that feeds primarily on invertebrates and earthworms as well as underground fungi. Individuals are usually solitary, with home ranges between 2 - 20 ha. This species is generally found to be more abundant in areas following post-fire regeneration due to increases in vegetation diversity and insect availability. Threats include predation by feral animals, habitat clearing and degradation, inbreeding depression, and inappropriate fire regimes (DEC 2007).	**No –** Preferred habitat not present..
Koala ***Phascolarctos cinereus***	V	-	Inhabits open eucalypt forest and woodland, containing a variety of preferred food tree species, depending on locality and seasonal conditions (Hindell & Lee 1991). Preferred food species include Scribbly Gum, Forest Red Gum, Tallow Wood, Grey Gum and Swamp Mahogany. Limited to areas of preferred food trees in eucalypt woodlands and forests (DECC 2006t).	**No –** Preferred habitat not present..
Eastern Pygmy Possum ***Cercatetus nanus***	V		This species is a small arboreal marsupial distributed along the coast of southern QLD, NSW, and Victoria, southeastern SA, and is present throughout Tasmania (Bowen and Goldingay 2000). It is generally a solitary species with home ranges of the males around 0.68 ha and females around 0.35 ha. Banksia spp. and myrtaceous shrubs and trees are favoured food sources and nesting sites in drier habitats. The eastern Pygmy-possum's diet consists largely of pollen and nectar from Banksia spp., Eucalyptus spp., Callistemon spp. and insects (Turner and Ward 1995). It nests in hollows in trees but its small size allows it to nest in a variety of places including under the bark of Eucalypts, forks of tea-trees, and in abandoned bird nests (Turner and Ward 1995). It is an agile climber and a very mobile species, and may undergo short-term seasonal migration possibly in response to food availability (Bowen and Goldingay 2000). The majority of births occur in spring to early autumn, but if abundant food supplies are available breeding will continue on the mainland throughout the year (Turner and Ward 1995).	**No –** Preferred habitat not present.
Yellow-bellied Glider ***Petaurus australis***	V	-	This is a large, highly mobile and vocal glider which can occupy home ranges between 20 to 85 ha to cover spatially dispersed and seasonally variable food resources. This species dens in tree hollows and each family group would typically have several den trees within their home range. The species inhabits tall mature eucalypt forest generally in areas with high rainfall and nutrient rich soils. They feed primarily on plant and insect exudates and extract sap by incising the trunks of preferred feed trees, often leaving a distinctive 'V'-shaped scar (DECC 2006s).	**No –** Preferred habitat not present.
Squirrel Glider ***Petaurus norfolcensis***	V		The Squirrel Glider inhabits dry schlerophyll forest of woodland in south-eastern Australia. Nectar and pollen are important dietary items, as well as eucalypt sap and wattle gum (Strahan 1995). It requires an abundance of tree hollows for refuge and nest sites (DEC Species Profile 2006). Distributed throughout central and coastal regions of NSW, this species inhabits dry sclerophyll forest and woodland and rarely rainforest or closed forest (Menkhorst & Knight 2001). Requires abundant hollow-bearing trees in which a family group of between 2 and 10 individuals will shelter. Home range is highly variable (0.5 to 9.0 ha) and is influenced primarily by resource availability	**No –** Preferred habitat not present.

Common Name (Species Name)	TSC Act Status	EPBC Act Status	Habitat Association	Likelihood of Occurring in Study Area
			(NPWS 1999). This species feeds on nectar, pollen, *Acacia* gum and insects, with a winter diet consisting mostly of winter flowers. Young disperse, due to male aggression, after approximately 1 year in their natal territory (NPWS 1999, Menkhorst & Knight 2001).	
Brush-tailed Bettong ***Bettongia penicillata penicillata***	Extinct	Extinct	This sub species is presumed extinct. The western population is known to inhabit dry sclerophyll forest with dense understorey. The last record of this species within the locality was from 1906.	**No**. No recent local records. Presumed extinct
Long-nosed Potoroo ***Potorous tridactlus***	V	V	This species of small mammal is generally restricted to areas with high annual rainfall, inhabiting coastal heath and dry and wet sclerophyll forests. Its major habitat requirement is relatively thick ground cover with occasional open areas and may consist of grass trees, sedges, ferns or heath, or low shrubs of tea-trees and Melaleucas where soil is light and sandy. It feeds on the fruiting bodies of underground-fruiting fungi, roots, tubers, insects and their larvae, and other soft-bodied animals in the soil. Breeding occurs biannually in late winter / early spring and in late summer, with one young being reared (Johnston 1995). In NSW it is generally restricted to coastal heaths and forests east of the Great Dividing Range, with an annual rainfall exceeding 760 mm. Threats include habitat loss and fragmentation due to land clearing for housing and agriculture, logging activities, predation by feral animals, and too frequent fires (DECC 2007).	**No –** Preferred habitat not present.
Parma Wallaby ***Macropus parma***	V		A small wallaby, with a head and body length up to 52 cm. Fur is a uniform greyish-brown on the back and shoulders with a dark stripe along the spine ending mid-back. It has a white stripe on the cheek and upper lip and a white belly. When hopping, remains close to the ground in an almost horizontal position with the forearms tucked tightly against the body, and the tail curved upwards in a shallow U-shape. Once occurred from north-eastern NSW to the Bega area in the southeast. Range is now confined to the coast and ranges of central and northern NSW. Preferred habitat is moist eucalypt forest with thick, shrubby understorey, often with nearby grassy areas, rainforest margins and occasionally drier eucalypt forest. Typically feed at night on grasses and herbs in more open eucalypt forest and the edges of nearby grassy areas. During the day they shelter in dense cover. (DECC 2007).	**No** – foraging habitat present on site however current know distribution limits likelihood of presence. One record from Cambewarra in the 1980's (limited information).
Brush-tailed Rock Wallaby ***Petrogale penicillata***	E	V	This species is a relatively small and muscular wallaby that is rufous in colour with a characteristic long and bushy, dark rufous-brown tail. It also has a characteristic white cheek-stripe and a black stripe from its forehead to the back of its head. It is known from southeast QLD to the Grampians in western Victoria, roughly following the line of the great Dividing Range, although the distribution of the species has declined and become fragmented (DEC 2007). The Brush-tailed Rock-Wallaby are found in rocky areas in a wide variety of habitats, including rainforest gullies, wet and dry sclerophyll forest, open woodland and rocky outcrops in semi-arid country. Sites with numerous ledges, caves and crevices are favoured (Strahan 1995).	**No –** Preferred rocky escarpment habitat not present.

Common Name (Species Name)	TSC Act Status	EPBC Act Status	Habitat Association	Likelihood of Occurring in Study Area
Smoky Mouse ***Pseudomys fumeus***	E	E	The Smoky Mouse *Pseudomys fumeus* is a small native rodent about 2-3 times the size of the introduced House Mouse. The Smoky Mouse is endemic to mainland south-eastern Australia, where it occurs in Victoria, NSW and the ACT. Recent records of the Smoky Mouse in NSW come from the far south coast hinterland and the Australian Alps. Despite considerable survey effort across the known NSW range for the species, the Nullica area is the only site where the Smoky Mouse is currently found (L. Broome pers. comm. September 2009). Across its current range, the Smoky Mouse occurs in a variety of vegetation communities, ranging from coastal heath to dry ridgeline forest, sub-alpine heath and, occasionally, wetter gullies (Menkhorst & Seebeck 1981).	**No –** Preferred habitat not present.
New Holland Mouse ***Pseudomys novaehollandiae***		V	The New Holland Mouse *Pseudomys novaehollandiae*, is a small, burrowing native rodent similar in size and appearance to the introduced house mouse. The New Holland Mouse has a fragmented distribution across Tasmania, Victoria, New South Wales and Queensland. Across the species' range, the total population size of mature individuals is estimated to be less than 10,000.(Menkhorst et al., 2008). New Holland Mouse is known to inhabit open heathlands, open woodlands with a heathland understorey and vegetated sand dunes. The home range of the New Holland Mouse ranges from 0.44 ha to 1.4 ha (Lazenby et al., 2008; Lazenby, 1999). The species peaks in abundance during early to mid stages of vegetation succession typically induced by fire (Posamentier and Recher, 1974; Braithwaite and Gullan, 1978; Fox and Fox, 1978; Fox and Mckay, 1981).	**No –** Preferred habitat not present.

E = Endangered, V = Vulnerable, M = Migratory, TSC Act = *Threatened Species Conservation Act 1995*, EPBC Act = *Environment Protection and Biodiversity Conservation Act 1999*
Yes = recorded in study area; Likely= suitable habitat and local records; Possible = not recorded but potential habitat exists; Unlikely = no suitable habitat or not present on the locality; No = Not present or likely to be present =marine species, no suitable habitat/conditions

Appendix C

TSC Act Assessment of Significance of potentially impacted threatened biota

Illawarra Subtropical Rainforest in the Sydney Basin Bioregion.

a) In the case of a threatened species, whether the action proposed is likely to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction.

The subject site contains approximately 0.5 hectares of heavily disturbed remnant Illawarra Subtropical Rainforest in a narrow band along part of Hyams Creek. The final determination for the Illawarra Subtropical Rainforest estimates that only about 3400 ha of the community remains with about 13% in conservation reserves.

The development of the subject site for residential purposes proposal is unlikely to result in adverse modification of the Illawarra Subtropical Rainforest within the study area. Illawarra Subtropical Rainforest within the subject site is limited to the Hyams Creek channel and banks, which are likely to be contained within a riparian buffer zone. Consequently the proposal will not modify or remove a significant area of Illawarra Subtropical Rainforest in relation to the regional distribution of the community.

b) In the case of an endangered population, whether the action proposed is likely to have an adverse effect on the life cycle of the species that constitutes the endangered population such that a viable local population of the species is likely to be placed at risk of extinction.

No endangered populations listed in Schedule *I* Part 2 of the *Threatened Species Conservation Act 1995*, are found in the study area. Consequently, there is no likelihood that the proposed activity can be regarded to involve any such populations even if individuals of such a population exist within the study area.

c) In the case of an endangered ecological community or critically endangered ecological community, whether the action proposed:

- **Is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction, or**
- **Is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction**.

The final determination for the Illawarra Subtropical Rainforest estimates that only about 3400 ha of the community remains with about 13% in conservation reserves. The development of the subject site for residential purposes proposal is unlikely to result in adverse modification of the Illawarra Subtropical Rainforest. Moreover, with a detailed rehabilitation plan the area occupied by this community locally may increase over time.

d) In relation to the habitat of a threatened species, population or ecological community:

- **The extent to which habitat is likely to be removed or modified as a result of the action proposed, and**
- **Whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed action, and**
- **The importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species, population or ecological community in the locality.**

The small amount of heavily disturbed remnant Illawarra Subtropical Rainforest within the subject site is not currently interconnected with other occurrences of the community. The proposal will thus not isolate the Illawarra Subtropical Rainforest within the subject site from currently interconnecting or proximate

areas of the community. Moreover, with a detailed rehabilitation plan the area occupied by this community locally may increase over time where connections to other remnant may be possible.

e) Whether the action proposed is likely to have an adverse effect on critical habitat (either directly or indirectly).

No critical habitat for this species has been listed in the Register of Critical Habitat kept by the Director General of Department of Environment and Conservation or the Register of Critical Habitat kept by the Director General of Department of Primary Industries.

f) Whether the action proposed is consistent with the objectives or actions of a recovery plan or threat abatement plan.

OEH is yet to prepare a recovery plan for this community however, the proposed action is unlikely to accelerate any of the threatened processes as no none will be removed or impacted, furthermore, the riparian corridor Hyams Creek including the full extent of Illawarra Subtropical rainforest on the northern boundary of the subject site is likely to be improved over time with rehabilitation and revegetation plans.

g) Whether the action proposed constitutes or is part of a key threatening process or is likely to result in the operation of, or increase the impact of, a key threatening process.

Because the proposed action is unlikely to impact on the Illawarra Subtropical Rainforest the action is not likely to contribute to a process that threatens, or may have the capability to threaten, the survival or evolutionary development of the community to any significant extent. Moreover, with funded rehabilitation and weed control the condition and potentially extent of the community in the locally may improve.

Conclusion

The proposed development is unlikely to impose a significant effect on the Illawarra Subtropical Rainforest given that the proposal:

- is unlikely to impact the community and will not directly result in any loss of this community; and
- may increase the present level of weed and feral animal controls in the locality; and
- includes the creation of a plated buffer of between 5 and 10 metres along Hyams Creek utilising local ISR endemics which will increase the area potentially occupied by this community locally which is in line with all management and recovery strategies.

On the basis of the above considerations, it is not likely that the proposed action will involve the imposition of a significant adverse effect on the Illawarra Subtropical Rainforest. Moreover with the creation of the riparian corridor, removal of grazing there is likely to be a increase in the area of occupancy of this community locally as a result of the proposal.

Greater Broad-nosed Bat

The Greater Broad-nosed Bat prefers moist gullies in mature coastal forest, woodland or rainforest. It feeds on moths and beetles hawked within 20 m of the ground along rows of trees lining creeks and the edges of patches of woodland (Churchill 1998). It is also known to forage for insects about 1 m above water in tree-lined creeks (Tanton 1995). Females gather in maternity colonies, usually in hollow tree trunks and give birth in January (Churchill 1998). The species usually roosts in tree hollows but also utilizes old buildings (NPWS 2002b) It inhabits a variety of habitats ranging from moist and dry eucalypt forest and rainforest to tall wet forest, however tends to prefers moist gullies in mature coastal forest or rainforest from the Atherton Tablelands in north QLD, along the coastal regions to southern NSW. The species is only found at low altitudes (below 500 m) (Churchill 1998; DEC 2006).

a) In the case of a threatened species, whether the action proposed is likely to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction.

The subject site provides limited habitat for the Greater Broad-nosed Bat in the form of foraging resources, particularly along Hyams Creek and to a lesser extent one potential roosting resources in the hollow bearing Camphor Laurel within the Hyams Creek vegetated corridor. Targeted surveys for this species during the survey period, involving echolocation call recording and analysis, identified two definite echolocation calls of this species foraging over a pond in the un-forested parts of Hyams Creek in 2005 (BES 2005).

The Greater Broad-nosed Bat is highly mobile and transient in their use of resources. The proposal will result in a minor reduction in open pasture which would be limited foraging habitat for these species, and is highly unlikely to significantly impact on roosting or breeding habitat for these species. A future residential development is unlikely to have an adverse effect of the life cycle of this mobile species. Moreover, with retention and or rehabilitation of the Hyams Creek Riparian Corridor the habitat available and connectivity to the south and north of the subject site will be improved thus potentially improving habitat locally for the Greater-Broad-nosed Bat.

b) In the case of an endangered population, whether the action proposed is likely to have an adverse effect on the life cycle of the species that constitutes the endangered population such that a viable local population of the species is likely to be placed at risk of extinction.

No endangered populations listed in Schedule *I* Part 2 of the *Threatened Species Conservation Act 1995*, are found in the study area. Consequently, there is no likelihood that the proposed activity can be regarded to involve any such populations even if individuals of such a population exist within the study area.

c) In the case of an endangered ecological community or critically endangered ecological community, whether the action proposed:

- **Is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction, or**
- **Is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction**.

Not applicable to a threatened species.

d) In relation to the habitat of a threatened species, population or ecological community:

- **The extent to which habitat is likely to be removed or modified as a result of the action proposed, and**
- **Whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed action, and**
- **The importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species, population or ecological community in the locality**.

The development of the subject site for residential purposes will involve the modification of approximately 7.8 ha of grazing pastures. The vegetation along Hyams Creek will not be adversely modified by the proposal. The subject site lies in the Sydney Basin Bioregion, which contains vast areas of similar vegetation and habitats and the area to be disturbed is insignificant in terms of the extent of habitat available for the species in the Sydney Basin Bioregion.

The proposal will not modify or remove a significant area of known threatened species habitat in the regional context.

The subject site provides limited habitat for the threatened Greater Broad-nosed Bat which is a highly mobile, flying species. The proposal will thus not isolate the habitat for this species along Hyams Creek from currently interconnecting or proximate areas of habitat. In addition, these are of habitat are unlikely to be adversely affected by the proposal and will continue to be available to the species.

e) Whether the action proposed is likely to have an adverse effect on critical habitat (either directly or indirectly).

No critical habitat for this species has been listed in the Register of Critical Habitat kept by the Director General of Department of Environment and Conservation or the Register of Critical Habitat kept by the Director General of Department of Primary Industries.

f) Whether the action proposed is consistent with the objectives or actions of a recovery plan or threat abatement plan.

OEH is yet to prepare a recovery plan for this species and does not currently list any Priorities Action Statements (PAS). There are no threat abatement plans applicable to this species.

However, 19 priority actions are listed in the Greater Broad-nosed Bat - – Profile (DEC 2005) that include practical things that must be done to recover a threatened species, which include the following relevant items:

a) High priority

- Prepare EIA guidelines which address the retention of hollow bearing trees maintaining diversity of age groups, species diversity, structural diversity. Give priority to largest hollow bearing trees.
- Ensure largest hollow bearing trees, inc. dead trees and paddock trees are given highest priority for retention in PVP assessments (offsets should include remnants in high productivity) and/or other land assessment tools.
- Ensure the Code of Practice for private native forestry includes adequate measures to protect large, hollow-bearing trees and viable numbers of recruit trees.
- Promote the conservation of these HCV private land areas using measures such as incentive funding to landholders, off-setting and biobanking, acquisition for reserve establishment or other means.

- Identify the effects of fragmentation on the species in a range of fragmented landscapes, such as cleared coastal river valleys. For example movement and persistence across a range of fragment sizes.
- Investigate the effectiveness of logging prescriptions.
- Research the degree of long-term fidelity to roost trees and roosting areas in order to assess their importance and the effects of their removal.
- Research the roosting ecology of tree-roosting bats. For example identifying the attributes of key roosts. .
- Study the ecology, habitat requirements and susceptibility to logging and other forestry practices of this little-known species.

b) *Medium Priority*

- Develop and promote State-wide bat awareness programs for schools, CMAs, landholders and industry groups etc.
- Identify important foraging range and key habitat components for this species.
- Research the effect of different burning regimes.
- Research the effectiveness of rehabilitation measures intended to increase bat populations in degraded landscapes, such as revegetating riparian zones.
- Study the susceptibility of this species to pesticide accumulation.
- Undertake a systematic survey of productive coastal river valleys to quantify the importance of private land relative to public lands.

c) *Low Priority*

- Raise awareness of the effects of pesticides.
- Quantify any benefits of local bat populations to reducing the impact of insect pests on commercial crops. .
- Undertake long-term monitoring of populations cross tenure in conjunction with other bat species to document changes.
- Identify areas of private land that contain high densities of large, hollow-bearing trees as areas of high conservation value in planning instruments and land management negotiations e.g. LEP, CAPs, PVPs.

Considering the proposed rezoning and future residential development is unlikely to impact recorded foraging habitat along Hyams Creek; will not remove any good quality roosting habitat including, caves, bridges; will retain all hollow-bearing trees within the study, and not restrict the movement of this highly mobile species, the action proposed that is generally consistent with the priory actions listed for the Greater Broad-nosed Bat.

g) Whether the action proposed constitutes or is part of a key threatening process or is likely to result in the operation of, or increase the impact of, a key threatening process.

A threatening process is defined under the TSC Act as “a process that threatens, or may have the capability to threaten, the survival or evolutionary development of species, populations or ecological communities”. Current threats to the status and distribution of the Greater Broad-nosed Bat include:

- Disturbance to roosting and summer breeding sites;
- Foraging habitats are being cleared for residential and agricultural developments, including clearing by residents within rural subdivisions;
- Loss of hollow-bearing trees;

- Pesticides and herbicides may reduce the availability of insects, or result in the accumulation of toxic residues in individuals' fat stores; and
- Changes to water regimes are likely to impact food resources, as is the use of pesticides and herbicides near waterways.

Relevant key threatening processes listed by the NSW Scientific Committee under Schedule 3 of the TSC Act for the Greater Broad-nosed Bat include:

- Clearing and fragmentation of native vegetation;
- Removal of dead wood, dead trees and logs; and
- Removal of hollow-bearing trees.

The proposed action does not accelerate any of the KTPs listed above, furthermore, the foraging habitat along the Hyams Creek Corridor is likely to be improved over time with rehabilitation and revegetation plans.

On the basis of the above considerations, the proposed rezoning for a residential development is not likely to contribute to a process that threatens, or may have the capability to threaten, the survival or evolutionary development of the Greater Broad-nosed Bat to any significant extent.

Conclusion

The proposed development is unlikely to impose a significant effect on the Greater Broad-nosed Bat given that the proposal:

- will not affect a substantial area of potential foraging habitat for the Greater Broad-nosed Bat, given that substantial habitat, both roosting and foraging habitat is present in the nearby areas and the Hyams Creek corridor will be retained and improved through planting and other management actions;
- will not create a barrier to the movement of this mobile species and is therefore unlikely to isolate an area of known habitat from currently interconnecting areas of potential habitat;
- may increase the present level of weed and feral animal controls in the locality; and

On the basis of the above considerations, it is not likely that the proposed action will involve the imposition of a significant effect on the Greater Broad-nosed Bat.

Large-footed Myotis (*Myotis macropus*)

a) In the case of a threatened species, whether the action proposed is likely to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction.

The Large-footed Myotis is primarily a coastal species that forages over streams and watercourses feeding on fish and insects, which it catches by raking its feet across the water surface. Breeding takes place during November or December, roosting in a variety of habitats including caves, mine shafts, stormwater channels, buildings, under bridges and infrequently in hollow-bearing trees or in dense foliage (DEC 2005). Roosts are usually in close proximity to water over which the bats forage.

The Large-footed Myotis is considered to be widespread throughout the coastal regions of eastern and northern Australia, ranging from the Kimberley in Western Australia to Victoria and South Australia (Churchill 1998). It is relatively common in tropical areas but uncommon further south (NPWS 1994), and rare in Victoria (Menkhorst and Lumsden 1995). This species has been recorded in mangroves, paperbark swamps and in a range of forest and woodland habitats (Churchill 1998).

The Large-footed Myotis was potentially recorded during the current field surveys through the presence of guano beneath a tree overhanging the water in Hyams Creek. There are numerous records across the locality (Figure 7). The creeklines and farm dams in the locality would provide potential foraging habitat for this species but the degraded nature of Hyams Creek would limit the availability of prey and therefore the habitat for the Large-footed Myotis and is not likely to provide critical habitat for this species. The large waterbodies in the wider locality such as the Minnamurra River are likely to represent more significant foraging habitat for the Large-footed Myotis.

Factors likely to disrupt the life cycle of the Large-footed Myotis (if present) are loss or disturbance of roost sites and foraging habitat. The study site does not contain any caves, mines or drains near or above water and is consequently unlikely to provide preferred roosting or maternity sites for the Large-footed Myotis. Whilst overhanging trees on the study site may provide temporary roost sites for this species, they are not considered a primary or critical roosting resource for the Large-footed Myotis. None of the trees in the Riparian Corridor would be affected by future residential development under the current rezoning application.

Given the above considerations, the proposed rezoning will not involve the disturbance or removal of critical foraging, roosting or breeding habitat for the Large-footed Myotis and is therefore unlikely to disrupt the lifecycle of this species such that a viable local population (if present) is likely to be placed at risk of extinction.

Moreover, with retention and or rehabilitation of the Hyams Creek Riparian Corridor the habitat available and connectivity to the south and north of the subject site will be improved thus potentially improving habitat locally for the Large-footed Myotis.

b) In the case of an endangered population, whether the action proposed is likely to have an adverse effect on the life cycle of the species that constitutes the endangered population such that a viable local population of the species is likely to be placed at risk of extinction.

No endangered populations listed in Schedule *I* Part 2 of the *Threatened Species Conservation Act 1995*, are found in the study area. Consequently, there is no likelihood that the proposed activity can be regarded to involve any such populations even if individuals of such a population exist within the study area.

c) In the case of an endangered ecological community or critically endangered ecological community, whether the action proposed:

- **Is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction, or**
- **Is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction.**

Not applicable to a threatened species.

d) in relation to the habitat of a threatened species, population or ecological community:

- **The extent to which habitat is likely to be removed or modified as a result of the action proposed, and**

The total extent of potential foraging habitat for the Large-footed Myotis is restricted to waters of Hyams Creek and none will be removed or modified as a result of the proposed rezoning and subsequent residential development. Riparian vegetation forms an important function in a healthy ecosystem, including providing breeding habitat for a number of insects, which provide an important food source for bats. No riparian vegetation clearance or disturbance is expected.

- **Whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed action, and**

The Large-footed Myotis is a highly mobile species. Given the minimal extent of marginal foraging habitat I the subject site it is highly unlikely that the proposed rezoning or future residential developments would involve an area of habitat for the Large-footed Myotis becoming fragmented or isolated from other areas of habitat. Furthermore, rehabilitation of the Hyams Creek Riparian Corridor may improve connections to surrounding areas of vegetation.

- **The importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species, population or ecological community in the locality.**

In the Sydney Basin Region the Large-footed Myotis is known to most commonly occur in the coastal and hinterland environments of the Central Coast, Cumberland Plain and the Southern Highlands. However, the representation in OEH reserves is considered to be relatively poor, with most of the captures in OEH estate occurring in Nattai, Royal and Popran National Parks (DEC 2004). The Wollondilly and Nattai Rivers are known to support good numbers of this species (DEC 2004), with records also in the Bargo area (Belik and Close 1997) and Burragorang State Conservation Area (DEC 2004). Roosting locations have not been detected in the reserves, though it is considered highly likely that they do occur.

Compared to the remaining potential habitat within the study area and wider locality, it is considered unlikely that the subject site would form an important component of habitat for the long-term survival of Large-footed Myotis in the locality.

e) Whether the action proposed is likely to have an adverse effect on critical habitat (either directly or indirectly).

No critical habitat currently listed in the Register of Critical Habitat kept by the Director General of Department of Environment and Climate Change or the Register of Critical Habitat kept by the Director General of Department of Primary Industries occurs within, or adjacent to, the study area.

f) Whether the action proposed is consistent with the objectives or actions of a recovery plan or threat abatement plan.

OEH is yet to prepare a recovery plan for this species and does not currently list any Priorities Action Statements (PAS). There are no threat abatement plans applicable to this species.

However, 15 priority actions are listed in the Large-footed Myotis – Profile (DEC 2005) that includes practical things that must be done to recover a threatened species, which include the following relevant items:

g) High Priority

- Study the ecology, habitat requirements and susceptibility to logging and other forestry practices of this little-known species.
- Resolve species taxonomy by morphology/genetics and reassess conservation status.
- Assess the importance by survey of estuaries and other tidal waterways for the species across its range.
- Survey large inland waterways for this species to determine distribution in Murray Darling Basin.

h) Medium Priority

- Promote roosting habitat in new artificial structures within the species range.
- Encourage recovery of natural hydrological regimes, including retention and rehabilitation of riparian vegetation.
- Determine susceptibility to logging.
- Investigate the effectiveness of logging prescriptions.
- Research to identify important foraging range and key habitat components for this species. Identify the importance of riparian vegetation to the species.

i) Low Priority

- Prepare EIA guidelines which address the retention of hollow bearing trees maintaining diversity of age groups, species diversity, structural diversity. Give priority to largest hollow bearing trees.
- Ensure the largest hollow bearing trees in riparian zones are given highest priority for retention in PVP assessments or other land clearing assessment tools.
- Identify, protect and enhance roost habitat beneath artificial structures (eg bridges), especially when due for replacement, and assess effectiveness of the actions.
- Better regulate pollution of waterways e.g. sewage and fertilizer run-off (eutrophication) and pesticide/herbicide leakage (chemical pollution) and thermal pollution.
- Identify the spatial population structure, including genetic isolation, movement and persistence across the species range. .
- Undertake long-term monitoring of populations cross tenure in conjunction with other bat species to document changes.

Considering the proposed rezoning and future residential development is unlikely to impact foraging habitat of this above water foraging specialist; will not remove any good quality roosting habitat including, caves, bridges; will retain all hollow-bearing trees within the study, and not restrict the movement of this highly mobile species, the action proposed that is generally consistent with the priory actions listed for the Large-footed Myotis.

j) Whether the action proposed constitutes or is part of a key threatening process or is likely to result in the operation of, or increase the impact of, a key threatening process.

A threatening process is defined under the TSC Act as "a process that threatens, or may have the capability to threaten, the survival or evolutionary development of species, populations or ecological communities". Current threats to the Large-footed Myotis include reduction in stream water quality affecting food resources, loss or disturbance of roosting sites, clearing adjacent to foraging areas and application of pesticides in or adjacent to foraging areas (DEC 2005).

Relevant key threatening processes listed by the NSW Scientific Committee under Schedule 3 of the TSC Act for this species include:

- Clearing of native vegetation;
- Removal of dead wood and trees;
- Loss of Hollow-bearing trees; and
- Degradation of native riparian vegetation along New South Wales water courses (*FM Act*).

The proposed action does not accelerate any of the KTPs listed above, furthermore, the foraging habitat along the Hyams Creek Corridor is likely to be improved over time with rehabilitation and revegetation plans.

On the basis of the above considerations, the proposed rezoning for a residential development is not likely to contribute to a process that threatens, or may have the capability to threaten, the survival or evolutionary development of the Large-footed Myotis to any significant extent.

Conclusion

The proposed action is unlikely to impose a significant effect on the Large-footed Myotis given that the proposal:

- will not affect a substantial area of potential foraging habitat for the Large-footed Myotis, given that substantial habitat, both roosting and foraging habitat is present in the nearby areas and the Hyams Creek corridor will be retained and improved through planting and other management actions;
- will not affect any known above/near standing water roosting or maternity sites for this species; and
- will not create a barrier to the movement of this mobile species and is therefore unlikely to isolate an area of known habitat from currently interconnecting areas of potential habitat; and
- may increase the present level of weed and feral animal controls in the locality through management of the Hyams Creek Riparian Corridor.

On the basis of the above considerations, it is not likely that the proposed development will involve the imposition of a significant effect on the Large-footed Myotis.

Appendix D

Protected Matter Search (EPBC Act).

Australian Government
Department of Sustainability, Environment, Water, Population and Communities

EPBC Act Protected Matters Report: Coordinates

This report provides general guidance on matters of national environmental significance and other matters protected by the EPBC Act in the area you have selected.

Information on the coverage of this report and qualifications on data supporting this report are contained in the caveat at the end of the report.

Information about the EPBC Act including significance guidelines, forms and application process details can be found at http://www.environment.gov.au/epbc/assessmentsapprovals/index.html

Report created: 28/10/11 15:39:41

Coordinates
Buffer: 10.0Km

Summary

Matters of National Environmental Significance

This part of the report summarises the matters of national environmental significance that may occur in, or may relate to, the area you nominated. Further information is available in the detail part of the report, which can be accessed by scrolling or following the links below. If you are proposing to undertake an activity that may have a significant impact on one or more matters of national environmental significance then you should consider the Administrative Guidelines on Significance - see http://www.environment.gov.au/epbc/assessmentsapprovals/guidelines/index.html.

World Heritage Properties:	None
National Heritage Places:	None
Wetlands of International Significance (Ramsar Wetlands):	None
Great Barrier Reef Marine Park:	None
Commonwealth Marine Areas:	None
Threatened Ecological Communitites:	1
Threatened Species:	55
Migratory Species:	38

Other Matters Protected by the EPBC Act

This part of the report summarises other matters protected under the Act that may relate to the area you nominated. Approval may be required for a proposed activity that significantly affects the environment on Commonwealth land, when the action is outside the Commonwealth land, or the environment anywhere when the action is taken on Commonwealth land. Approval may also be required for the Commonwealth or Commonwealth agencies proposing to take an action that is likely to have a significant impact on the environment anywhere.

The EPBC Act protects the environment on Commonwealth land, the environment from the actions taken on Commonwealth land, and the environment from actions taken by Commonwealth agencies. As heritage values of a place are part of the 'environment', these aspects of the EPBC Act protect the Commonwealth Heritage values of a Commonwealth Heritage place and the heritage values of a place on the Register of the National Estate. Information on the new heritage laws can be found at http://www.environment.gov.au/heritage/index.html

Please note that the current dataset on Commonwealth land is not complete. Further information on Commonwealth land would need to be obtained from relevant sources including Commonwealth agencies, local agencies, and land tenure maps.

A permit may be required for activities in or on a Commonwealth area that may affect a member of a listed threatened species or ecological community, a member of a listed migratory species, whales and other cetaceans, or a member of a listed marine species. Information on EPBC Act permit requirements and application forms can be found at http://www.environment.gov.au/epbc/permits/index.html.

Commonwealth Lands:	5
Commonwealth Heritage Places:	1
Listed Marine Species:	50
Whales and Other Cetaceans:	11

Critical Habitats:	None
Commonwealth Reserves:	None

Report Summary for Extra Information

This part of the report provides information that may also be relevant to the area you have nominated.

Place on the RNE:	36
State and Territory Reserves:	2
Regional Forest Agreements:	1
Invasive Species:	19
Nationally Important Wetlands:	1

Details

Matters of National Environmental Significance

Threatened Ecological Communities [Resource Information]

For threatened ecological communities where the distribution is well known, maps are derived from recovery plans, State vegetation maps, remote sensing imagery and other sources. Where threatened ecological community distributions are less well known, existing vegetation maps and point location data are used to produce indicative distribution maps.

Name	Status	Type of Presence
Littoral Rainforest and Coastal Vine Thickets of Eastern Australia	Critically Endangered	Community likely to occur within area

Threatened Species [Resource Information]

Name	Status	Type of Presence
BIRDS		
Anthochaera phrygia Regent Honeyeater [82338]	Endangered	Species or species habitat likely to occur within area
Botaurus poiciloptilus Australasian Bittern [1001]	Endangered	Species or species habitat known to occur within area
Dasyornis brachypterus Eastern Bristlebird [533]	Endangered	Species or species habitat likely to occur within area
Diomedea exulans antipodensis Antipodean Albatross [82269]	Vulnerable	Species or species habitat may occur within area
Diomedea exulans gibsoni Gibson's Albatross [82271]	Vulnerable	Species or species habitat may occur within area
Fregetta grallaria grallaria White-bellied Storm-Petrel (Tasman Sea), White-bellied Storm-Petrel (Australasian) [64438]	Vulnerable	Species or species habitat likely to occur within area
Lathamus discolor Swift Parrot [744]	Endangered	Species or species habitat likely to occur within area

Macronectes giganteus		
Southern Giant-Petrel [1060]	Endangered	Species or species habitat may occur within area
Macronectes halli		
Northern Giant-Petrel [1061]	Vulnerable	Species or species habitat may occur within area
Neophema chrysogaster		
Orange-bellied Parrot [747]	Critically Endangered	Species or species habitat may occur within area
Pterodroma neglecta neglecta		
Kermadec Petrel (western) [64450]	Vulnerable	Species or species habitat may occur within area
Rostratula australis		
Australian Painted Snipe [77037]	Vulnerable	Species or species habitat may occur within area
Sternula nereis nereis		
Fairy Tern (Australian) [82950]	Vulnerable	Species or species habitat likely to occur within area
Thalassarche bulleri		
Buller's Albatross [64460]	Vulnerable	Species or species habitat may occur within area
Thalassarche cauta cauta		
Shy Albatross, Tasmanian Shy Albatross [82345]	Vulnerable	Species or species habitat may occur within area
Thalassarche cauta salvini		
Salvin's Albatross [82343]	Vulnerable	Species or species habitat may occur within area
Thalassarche cauta steadi		
White-capped Albatross [82344]	Vulnerable	Species or species habitat may occur within area
Thalassarche melanophris impavida		
Campbell Albatross [82449]	Vulnerable	Species or species habitat may occur within area
FISH		
Macquaria australasica		
Macquarie Perch [66632]	Endangered	Species or species habitat may occur within area
Prototroctes maraena		
Australian Grayling [26179]	Vulnerable	Species or species habitat likely to occur within area
FROGS		
Heleioporus australiacus		
Giant Burrowing Frog [1973]	Vulnerable	Species or species habitat likely to occur within area
Litoria aurea		
Green and Golden Bell Frog [1870]	Vulnerable	Species or species habitat likely to occur within area
Litoria littlejohni		
Littlejohn's Tree Frog, Heath Frog [64733]	Vulnerable	Species or species habitat may occur within area
Mixophyes balbus		
Stuttering Frog, Southern Barred Frog (in Victoria) [1942]	Vulnerable	Species or species habitat likely to occur within area
MAMMALS		
Chalinolobus dwyeri		
Large-eared Pied Bat, Large Pied Bat [183]	Vulnerable	Species or species habitat may occur within area
Dasyurus maculatus maculatus (SE mainland population)		

Spot-tailed Quoll, Spotted-tail Quoll, Tiger Quoll (southeastern mainland population) [75184]	Endangered	Species or species habitat may occur within area
Eubalaena australis		
Southern Right Whale [40]	Endangered	Species or species habitat known to occur within area
Isoodon obesulus obesulus		
Southern Brown Bandicoot [68050]	Endangered	Species or species habitat known to occur within area
Megaptera novaeangliae		
Humpback Whale [38]	Vulnerable	Species or species habitat known to occur within area
Petrogale penicillata		
Brush-tailed Rock-wallaby [225]	Vulnerable	Species or species habitat may occur within area
Potorous tridactylus tridactylus		
Long-nosed Potoroo (SE mainland) [66645]	Vulnerable	Species or species habitat may occur within area
Pseudomys fumeus		
Konoom, Smoky Mouse [88]	Endangered	Species or species habitat may occur within area
Pseudomys novaehollandiae		
New Holland Mouse [96]	Vulnerable	Species or species habitat likely to occur within area
Pteropus poliocephalus		
Grey-headed Flying-fox [186]	Vulnerable	Roosting known to occur within area
PLANTS		
Boronia deanei		
Deane's Boronia [8397]	Vulnerable	Species or species habitat likely to occur within area
Caladenia tessellata		
Thick-lipped Spider-orchid, Daddy Long-legs [2119]	Vulnerable	Species or species habitat likely to occur within area
Cryptostylis hunteriana		
Leafless Tongue-orchid [19533]	Vulnerable	Species or species habitat may occur within area
Cynanchum elegans		
White-flowered Wax Plant [12533]	Endangered	Species or species habitat likely to occur within area
Daphnandra johnsonii		
a tree [67186]	Endangered	Species or species habitat likely to occur within area
Irenepharsus trypherus		
Delicate Cress, Illawarra Irene [14664]	Endangered	Species or species habitat likely to occur within area
Melaleuca biconvexa		
Biconvex Paperbark [5583]	Vulnerable	Species or species habitat may occur within area
Pimelea spicata		
[20834]	Endangered	Species or species habitat may occur within area
Pterostylis gibbosa		
Illawarra Greenhood, Rufa Greenhood, Pouched	Endangered	Species or species habitat known to occur within area

Greenhood [4562]		
Pterostylis pulchella		
Pretty Greenhood [6448]	Vulnerable	Species or species habitat likely to occur within area
Thelymitra sp. Kangaloon (D.L.Jones 18108)		
Kangaloon Sun-orchid [81971]	Critically Endangered	Species or species habitat likely to occur within area
Thesium australe		
Austral Toadflax, Toadflax [15202]	Vulnerable	Species or species habitat likely to occur within area
Zieria granulata		
Hill Zieria, Hilly Zieria, Illawarra Zieria [17147]	Endangered	Species or species habitat likely to occur within area
REPTILES		
Caretta caretta		
Loggerhead Turtle [1763]	Endangered	Species or species habitat likely to occur within area
Chelonia mydas		
Green Turtle [1765]	Vulnerable	Species or species habitat known to occur within area
Dermochelys coriacea		
Leatherback Turtle, Leathery Turtle, Luth [1768]	Endangered	Species or species habitat likely to occur within area
Eretmochelys imbricata		
Hawksbill Turtle [1766]	Vulnerable	Species or species habitat likely to occur within area
Hoplocephalus bungaroides		
Broad-headed Snake [1182]	Vulnerable	Species or species habitat likely to occur within area
SHARKS		
Carcharias taurus (east coast population)		
Grey Nurse Shark (east coast population) [68751]	Critically Endangered	Species or species habitat may occur within area
Carcharodon carcharias		
Great White Shark [64470]	Vulnerable	Species or species habitat may occur within area
Rhincodon typus		
Whale Shark [66680]	Vulnerable	Species or species habitat may occur within area

Migratory Species [Resource Information]

Name	Status	Type of Presence
Migratory Marine Birds		
Apus pacificus		
Fork-tailed Swift [678]		Species or species habitat may occur within area
Ardea alba		
Great Egret, White Egret [59541]		Species or species habitat may occur within area
Ardea ibis		
Cattle Egret [59542]		Species or species habitat may occur within area
Diomedea antipodensis		
Antipodean Albatross [64458]	Vulnerable*	Species or species habitat may occur within area
Diomedea gibsoni		
Gibson's Albatross [64466]	Vulnerable*	Species or species habitat may occur within area

Macronectes giganteus		
Southern Giant-Petrel [1060]	Endangered	Species or species habitat may occur within area
Macronectes halli		
Northern Giant-Petrel [1061]	Vulnerable	Species or species habitat may occur within area
Sterna albifrons		
Little Tern [813]		Species or species habitat may occur within area
Thalassarche bulleri		
Buller's Albatross [64460]	Vulnerable	Species or species habitat may occur within area
Thalassarche cauta (sensu stricto)		
Shy Albatross, Tasmanian Shy Albatross [64697]	Vulnerable*	Species or species habitat may occur within area
Thalassarche impavida		
Campbell Albatross [64459]	Vulnerable*	Species or species habitat may occur within area
Thalassarche salvini		
Salvin's Albatross [64463]	Vulnerable*	Species or species habitat may occur within area
Thalassarche steadi		
White-capped Albatross [64462]	Vulnerable*	Species or species habitat may occur within area
Migratory Marine Species		
Balaenoptera edeni		
Bryde's Whale [35]		Species or species habitat may occur within area
Caperea marginata		
Pygmy Right Whale [39]		Species or species habitat may occur within area
Carcharodon carcharias		
Great White Shark [64470]	Vulnerable	Species or species habitat may occur within area
Caretta caretta		
Loggerhead Turtle [1763]	Endangered	Species or species habitat likely to occur within area
Chelonia mydas		
Green Turtle [1765]	Vulnerable	Species or species habitat known to occur within area
Dermochelys coriacea		
Leatherback Turtle, Leathery Turtle, Luth [1768]	Endangered	Species or species habitat likely to occur within area
Eretmochelys imbricata		
Hawksbill Turtle [1766]	Vulnerable	Species or species habitat likely to occur within area
Eubalaena australis		
Southern Right Whale [40]	Endangered	Species or species habitat known to occur within area
Lagenorhynchus obscurus		
Dusky Dolphin [43]		Species or species habitat may occur within area
Lamna nasus		
Porbeagle, Mackerel Shark [83288]		Species or species habitat likely to occur within area
Megaptera novaeangliae		
Humpback Whale [38]	Vulnerable	Species or species habitat known to occur within area
Orcinus orca		
Killer Whale, Orca [46]		Species or species habitat may occur within area
Rhincodon typus		
Whale Shark [66680]	Vulnerable	Species or species habitat may occur within area

Migratory Terrestrial Species		
Haliaeetus leucogaster		
White-bellied Sea-Eagle [943]		Species or species habitat likely to occur within area
Hirundapus caudacutus		
White-throated Needletail [682]		Species or species habitat may occur within area
Merops ornatus		
Rainbow Bee-eater [670]		Species or species habitat may occur within area
Monarcha melanopsis		
Black-faced Monarch [609]		Breeding may occur within area
Myiagra cyanoleuca		
Satin Flycatcher [612]		Breeding likely to occur within area
Neophema chrysogaster		
Orange-bellied Parrot [747]	Critically Endangered	Species or species habitat may occur within area
Rhipidura rufifrons		
Rufous Fantail [592]		Breeding may occur within area
Xanthomyza phrygia		
Regent Honeyeater [430]	Endangered*	Species or species habitat likely to occur within area

Migratory Wetlands Species		
Ardea alba		
Great Egret, White Egret [59541]		Species or species habitat may occur within area
Ardea ibis		
Cattle Egret [59542]		Species or species habitat may occur within area
Gallinago hardwickii		
Latham's Snipe, Japanese Snipe [863]		Species or species habitat may occur within area
Rostratula benghalensis s. lat.		
Painted Snipe [889]	Vulnerable*	Species or species habitat may occur within area

Other Matters Protected by the EPBC Act

Commonwealth Lands [Resource Information]

The Commonwealth area listed below may indicate the presence of Commonwealth land in this vicinity. Due to the unreliability of the data source, all proposals should be checked as to whether it impacts on a Commonwealth area, before making a definitive decision. Contact the State or Territory government land department for further information.

Commonwealth Land - Director of War Service Homes
Commonwealth Land - Australian Postal Commission
Commonwealth Land - Commonwealth Trading Bank of Australia
Commonwealth Land - Australian Telecommunications Commission
Commonwealth Land - Defence Service Homes Corporation

Commonwealth Heritage Places [Resource Information]

Name	Status
Historic	
Kiama Post Office NSW	Nominated place

Listed Marine Species [Resource Information]

Name	Status	Type of Presence
Birds		

Apus pacificus		
Fork-tailed Swift [678]		Species or species habitat may occur within area
Ardea alba		
Great Egret, White Egret [59541]		Species or species habitat may occur within area
Ardea ibis		
Cattle Egret [59542]		Species or species habitat may occur within area
Diomedea antipodensis		
Antipodean Albatross [64458]	Vulnerable*	Species or species habitat may occur within area
Diomedea gibsoni		
Gibson's Albatross [64466]	Vulnerable*	Species or species habitat may occur within area
Gallinago hardwickii		
Latham's Snipe, Japanese Snipe [863]		Species or species habitat may occur within area
Haliaeetus leucogaster		
White-bellied Sea-Eagle [943]		Species or species habitat likely to occur within area
Hirundapus caudacutus		
White-throated Needletail [682]		Species or species habitat may occur within area
Lathamus discolor		
Swift Parrot [744]	Endangered	Species or species habitat likely to occur within area
Macronectes giganteus		
Southern Giant-Petrel [1060]	Endangered	Species or species habitat may occur within area
Macronectes halli		
Northern Giant-Petrel [1061]	Vulnerable	Species or species habitat may occur within area
Merops ornatus		
Rainbow Bee-eater [670]		Species or species habitat may occur within area
Monarcha melanopsis		
Black-faced Monarch [609]		Breeding may occur within area
Myiagra cyanoleuca		
Satin Flycatcher [612]		Breeding likely to occur within area
Neophema chrysogaster		
Orange-bellied Parrot [747]	Critically Endangered	Species or species habitat may occur within area
Rhipidura rufifrons		
Rufous Fantail [592]		Breeding may occur within area
Rostratula benghalensis s. lat.		
Painted Snipe [889]	Vulnerable*	Species or species habitat may occur within area
Sterna albifrons		
Little Tern [813]		Species or species habitat may occur within area
Thalassarche bulleri		
Buller's Albatross [64460]	Vulnerable	Species or species habitat may occur within area
Thalassarche cauta (sensu stricto)		
Shy Albatross, Tasmanian Shy Albatross [64697]	Vulnerable*	Species or species habitat may occur within area
Thalassarche impavida		
Campbell Albatross [64459]	Vulnerable*	Species or species habitat may occur within area
Thalassarche salvini		
Salvin's Albatross [64463]	Vulnerable*	Species or species habitat may occur within area
Thalassarche steadi		
White-capped Albatross	Vulnerable*	Species or species habitat may occur within area

[64462]

Fish

Acentronura tentaculata	
Shortpouch Pygmy Pipehorse [66187]	Species or species habitat may occur within area
Cosmocampus howensis	
Lord Howe Pipefish [66208]	Species or species habitat may occur within area
Heraldia nocturna	
Upside-down Pipefish, Eastern Upside-down Pipefish, Eastern Upside-down Pipefish [66227]	Species or species habitat may occur within area
Hippocampus abdominalis	
Bigbelly Seahorse, Eastern Potbelly Seahorse, New Zealand Potbelly Seahorse [66233]	Species or species habitat may occur within area
Hippocampus breviceps	
Short-head Seahorse, Short-snouted Seahorse [66235]	Species or species habitat may occur within area
Hippocampus whitei	
White's Seahorse, Crowned Seahorse, Sydney Seahorse [66240]	Species or species habitat may occur within area
Histiogamphelus briggsii	
Crested Pipefish, Briggs' Crested Pipefish, Briggs' Pipefish [66242]	Species or species habitat may occur within area
Kimblaeus bassensis	
Trawl Pipefish, Bass Strait Pipefish [66247]	Species or species habitat may occur within area
Lissocampus runa	
Javelin Pipefish [66251]	Species or species habitat may occur within area
Maroubra perserrata	
Sawtooth Pipefish [66252]	Species or species habitat may occur within area
Notiocampus ruber	
Red Pipefish [66265]	Species or species habitat may occur within area
Phyllopteryx taeniolatus	
Common Seadragon, Weedy Seadragon [66268]	Species or species habitat may occur within area
Solegnathus spinosissimus	
Spiny Pipehorse, Australian Spiny Pipehorse [66275]	Species or species habitat may occur within area
Solenostomus cyanopterus	
Robust Ghostpipefish, Blue-finned Ghost Pipefish, [66183]	Species or species habitat may occur within area
Solenostomus paegnius	
Rough-snout Ghost Pipefish [68425]	Species or species habitat may occur within area
Stigmatopora argus	
Spotted Pipefish, Gulf Pipefish [66276]	Species or species habitat may occur within area
Stigmatopora nigra	
Widebody Pipefish,	Species or species habitat may occur within area

Wide-bodied Pipefish, Black Pipefish [66277]		
Syngnathoides biaculeatus		
Double-end Pipehorse, Double-ended Pipehorse, Alligator Pipefish [66279]		Species or species habitat may occur within area
Urocampus carinirostris		
Hairy Pipefish [66282]		Species or species habitat may occur within area
Vanacampus margaritifer		
Mother-of-pearl Pipefish [66283]		Species or species habitat may occur within area
Vanacampus phillipi		
Port Phillip Pipefish [66284]		Species or species habitat may occur within area
Mammals		
Arctocephalus forsteri		
New Zealand Fur-seal [20]		Species or species habitat may occur within area
Arctocephalus pusillus		
Australian Fur-seal, Australo-African Fur-seal [21]		Species or species habitat may occur within area
Reptiles		
Caretta caretta		
Loggerhead Turtle [1763]	Endangered	Species or species habitat likely to occur within area
Chelonia mydas		
Green Turtle [1765]	Vulnerable	Species or species habitat known to occur within area
Dermochelys coriacea		
Leatherback Turtle, Leathery Turtle, Luth [1768]	Endangered	Species or species habitat likely to occur within area
Eretmochelys imbricata		
Hawksbill Turtle [1766]	Vulnerable	Species or species habitat likely to occur within area

Whales and Other Cetaceans [Resource Information]

Name	Status	Type of Presence
Mammals		
Balaenoptera acutorostrata		
Minke Whale [33]		Species or species habitat may occur within area
Balaenoptera edeni		
Bryde's Whale [35]		Species or species habitat may occur within area
Caperea marginata		
Pygmy Right Whale [39]		Species or species habitat may occur within area
Delphinus delphis		
Common Dophin, Short-beaked Common Dolphin [60]		Species or species habitat may occur within area
Eubalaena australis		
Southern Right Whale [40]	Endangered	Species or species habitat known to occur within area
Grampus griseus		
Risso's Dolphin, Grampus [64]		Species or species habitat may occur within area
Lagenorhynchus obscurus		
Dusky Dolphin [43]		Species or species habitat may occur within area
Megaptera novaeangliae		

Humpback Whale [38]	Vulnerable	Species or species habitat known to occur within area
Orcinus orca Killer Whale, Orca [46]		Species or species habitat may occur within area
Tursiops aduncus Indian Ocean Bottlenose Dolphin, Spotted Bottlenose Dolphin [68418]		Species or species habitat likely to occur within area
Tursiops truncatus s. str. Bottlenose Dolphin [68417]		Species or species habitat may occur within area

Extra Information

Places on the RNE [Resource Information]

Note that not all Indigenous sites may be listed.

Name	Status
Natural	
Barren Grounds Nature Reserve NSW	Registered
Bass Point Marine Area NSW	Registered
Bombo Headland Quarry Geological Site NSW	Registered
Indigenous	
Barren Grounds Art Site NSW	Indicative Place
Foxground Art Site NSW	Registered
Historic	
Albion Park Rail Railway Station Group NSW	Indicative Place
Aughinvar NSW	Indicative Place
Berry District NSW	Indicative Place
Catholic Presbytery NSW	Indicative Place
Christ Church Anglican Church NSW	Indicative Place
Coach House Art Galley NSW	Indicative Place
Dalmeny NSW	Indicative Place
Dry Stone Walls NSW	Indicative Place
Fredericks Big Star Stores NSW	Indicative Place
House NSW	Indicative Place
House NSW	Indicative Place
Jamberoo Valley NSW	Indicative Place
Kangaroo Valley NSW	Indicative Place
Kellys Cottage & Outbuildings NSW	Indicative Place
Kiama Courthouse NSW	Indicative Place
Mount Vernon NSW	Indicative Place
Pilot Station Residence (former) NSW	Indicative Place
St Matthews Catholic Church NSW	Indicative Place
St Stephens Presbyterian Church NSW	Indicative Place
Alne Bank Homestead NSW	Registered
Bush Bank Steam Mill and Associated Field Stone Walls NSW	Registered
Hartwell House NSW	Registered
Infants School NSW	Registered
Kiama Post Office NSW	Registered
Minnamurra House NSW	Registered
Park Mount NSW	Registered
Police Station NSW	Registered

Public School (1878 Building) NSW	Registered
Scots Presbyterian Church & Surrounds NSW	Registered
Terragong House and Home Paddock NSW	Registered
Westpac Bank NSW	Registered

State and Territory Reserves [Resource Information]

Budderoo, NSW
Barren Grounds, NSW

Regional Forest Agreements [Resource Information]

Note that all areas with completed RFAs have been included.
Southern RFA, New South Wales

Invasive Species [Resource Information]

Weeds reported here are the 20 species of national significance (WoNS), along with other introduced plants that are considered by the States and Territories to pose a particularly significant threat to biodiversity. The following feral animals are reported: Goat, Red Fox, Cat, Rabbit, Pig, Water Buffalo and Cane Toad. Maps from Landscape Health Project, National Land and Water Resouces Audit, 2001.

Name	Status	Type of Presence
Mammals		
Capra hircus Goat [2]		Species or species habitat likely to occur within area
Felis catus Cat, House Cat, Domestic Cat [19]		Species or species habitat likely to occur within area
Oryctolagus cuniculus Rabbit, European Rabbit [128]		Species or species habitat likely to occur within area
Sus scrofa Pig [6]		Species or species habitat likely to occur within area
Vulpes vulpes Red Fox, Fox [18]		Species or species habitat likely to occur within area
Plants		
Alternanthera philoxeroides Alligator Weed [11620]		Species or species habitat likely to occur within area
Asparagus asparagoides Bridal Creeper, Bridal Veil Creeper, Smilax, Florist's Smilax, Smilax Asparagus [22473]		Species or species habitat likely to occur within area
Cabomba caroliniana Cabomba, Fanwort, Carolina Watershield, Fish Grass, Washington Grass, Watershield, Carolina Fanwort, Common Cabomba [5171]		Species or species habitat likely to occur within area
Chrysanthemoides monilifera Bitou Bush, Boneseed [18983]		Species or species habitat may occur within area
Genista sp. X Genista monspessulana Broom [67538]		Species or species habitat may occur within area

Lantana camara	
Lantana, Common Lantana, Kamara Lantana, Large-leaf Lantana, Pink Flowered Lantana, Red Flowered Lantana, Red-Flowered Sage, White Sage, Wild Sage [10892]	Species or species habitat likely to occur within area
Lycium ferocissimum	
African Boxthorn, Boxthorn [19235]	Species or species habitat may occur within area
Nassella neesiana	
Chilean Needle grass [67699]	Species or species habitat likely to occur within area
Nassella trichotoma	
Serrated Tussock, Yass River Tussock, Yass Tussock, Nassella Tussock (NZ) [18884]	Species or species habitat likely to occur within area
Pinus radiata	
Radiata Pine Monterey Pine, Insignis Pine, Wilding Pine [20780]	Species or species habitat may occur within area
Rubus fruticosus aggregate	
Blackberry, European Blackberry [68406]	Species or species habitat likely to occur within area
Salix spp. except S.babylonica, S.x calodendron & S.x reichardtiji	
Willows except Weeping Willow, Pussy Willow and Sterile Pussy Willow [68497]	Species or species habitat likely to occur within area
Salvinia molesta	
Salvinia, Giant Salvinia, Aquarium Watermoss, Kariba Weed [13665]	Species or species habitat likely to occur within area
Ulex europaeus	
Gorse, Furze [7693]	Species or species habitat likely to occur within area

Nationally Important Wetlands **[Resource Information]**

Minnamurra River Estuary, NSW

Caveat

The information presented in this report has been provided by a range of data sources as acknowledged at the end of the report.

This report is designed to assist in identifying the locations of places which may be relevant in determining obligations under the Environment Protection and Biodiversity Conservation Act 1999. It holds mapped locations of World Heritage and Register of National Estate properties, Wetlands of International Importance, Commonwealth and State/Territory reserves, listed threatened, migratory and marine species and listed threatened ecological communities. Mapping of Commonwealth land is not complete at this stage. Maps have been collated from a range of sources at various resolutions.

Not all species listed under the EPBC Act have been mapped (see below) and therefore a report is a general guide only. Where available data supports mapping, the type of presence that can be determined from the data is indicated in general terms. People using this information in making a referral may need to consider the qualifications below and may need to seek and consider other information sources.

For threatened ecological communities where the distribution is well known, maps are derived from recovery plans, State vegetation maps, remote sensing imagery and other sources. Where threatened ecological community distributions are less well known, existing vegetation maps and point location data are used to produce indicative distribution maps.

For species where the distributions are well known, maps are digitised from sources such as recovery plans and detailed habitat studies. Where appropriate, core breeding, foraging and roosting areas are indicated under 'type of presence'. For species whose distributions are less well known, point locations are collated from government wildlife authorities, museums, and non-government organisations; bioclimatic distribution models are generated and these validated by experts. In some cases, the distribution maps are based solely on expert knowledge.

Only selected species covered by the following provisions of the EPBC Act have been mapped:
- migratory and
- marine

The following species and ecological communities have not been mapped and do not appear in reports produced from this database:
- threatened species listed as extinct or considered as vagrants
- some species and ecological communities that have only recently been listed
- some terrestrial species that overfly the Commonwealth marine area
- migratory species that are very widespread, vagrant, or only occur in small numbers.

The following groups have been mapped, but may not cover the complete distribution of the species:
- non-threatened seabirds which have only been mapped for recorded breeding sites;
- seals which have only been mapped for breeding sites near the Australian continent.

Such breeding sites may be important for the protection of the Commonwealth Marine environment.

Coordinates

-34.64911 150.77264

Acknowledgements

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-Department of Environment, Climate Change and Water, New South Wales
-Department of Sustainability and Environment, Victoria
-Department of Primary Industries, Parks, Water and Environment, Tasmania
-Department of Environment and Natural Resources, South Australia
-Parks and Wildlife Service NT, NT Dept of Natural Resources, Environment and the Arts
-Environmental and Resource Management, Queensland
-Department of Environment and Conservation, Western Australia
-Department of the Environment, Climate Change, Energy and Water
-Birds Australia
-Australian Bird and Bat Banding Scheme
-Australian National Wildlife Collection
-Natural history museums of Australia
-Museum Victoria
-Australian Museum
-SA Museum
-Queensland Museum
-Online Zoological Collections of Australian Museums

-Queensland Herbarium
-National Herbarium of NSW
-Royal Botanic Gardens and National Herbarium of Victoria
-Tasmanian Herbarium
-State Herbarium of South Australia
-Northern Territory Herbarium
-Western Australian Herbarium
-Australian National Herbarium, Atherton and Canberra
-University of New England
-Ocean Biogeographic Information System
-Australian Government, Department of Defence
-State Forests of NSW
-Other groups and individuals

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Please feel free to provide feedback via the Contact Us page.

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