# Attachment 2 – Ecological Constraints Assessment

# MURRAY'S RISE: REZONING APPLICATION FOR LAND IN LOWER BELFORD

## Ecological Constraints and Opportunities Assessment

For:

**BELFORD LAND CORPORATION**

August 2011

Final Report

**Cumberland Ecology**
PO Box 2474, Carlingford Court 2118

**Report No. 8081RP2**

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

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Chapter 1

INTRODUCTION

# Introduction

## 1.1 Purpose

This assessment has been prepared on behalf of Belford Land Corporation to support a rezoning application for "Murray's Rise"; an area of land situated in Lower Belford in the Hunter Valley (hereafter referred to as the 'subject site'). The purpose of this report is to describe the current biodiversity values of the subject site with respect to species, populations and endangered ecological communities that are listed under the schedules of the *Threatened Species Conservation Act 1995* (TSC Act) and the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act), and to identify areas of ecological constraint that will advise the zoning process and subsequent concept design.

Specifically, this assessment aims to:

- Describe and map vegetation communities, identifying threatened communities listed under the TSC Act and EPBC Act and any other communities of high conservation value;
- Survey and map locations of any threatened species and use of the subject site for threatened flora and fauna species listed under the TSC Act and EPBC Act;
- Identify and map key areas of habitat for fauna and faunal movement corridors;
- Identify areas according to preferred future land use; and
- Make recommendations for measures to facilitate the appropriate management of flora and fauna issues alongside future development such that biodiversity values can be maintained or improved.

## 1.2 Background

Belford Land Corporation is proposing a rezoning of approximately 140 hectares of rural land in Lower Belford. As part of this proposal, Belford Land Corporation is seeking to amend the existing zoning (Zone 1a - Rural) to permit rural-residential subdivision (Zone 7b – Environmental Living) of the land, which is consistent with the Singleton Land Use

Strategy and other key rezoning considerations. The Singleton Land Use Strategy was adopted in 2008 and confirms the Lower Belford Candidate Area of which the subject site is a part of, as a suitable area for rural residential development.

The proposal to rezone the subject site to Environmental Living will facilitate future subdivision for which an average lot area of 1 hectare and a minimum lot area of 8,000 $m^2$ are proposed. Suitable existing cleared building envelopes of about 400 $m^2$ will be provided within each lot. To support the future development of the subject site, the proposal also calls for reticulated water services and on-site sewerage disposal.

In total, the average footprint per lot is likely to be about 2,500 $m^2$ in area and will include the following:

- 400 $m^2$ (dwelling and bushfire asset protection);
- 400 $m^2$ (ancillary dwellings and bushfire asset protection);
- 750 $m^2$ (on site sewerage disposal, which is likely to comprise a 150 m2 septic tank and a flexible pipeline and sprinkler system);
- 200 $m^2$ (driveway); and
- 700 $m^2$ (average road frontage).

The subject site that is the focus of this assessment comprises the following allotments (**Figure 1.1**):

- Lot 11, DP 844443;
- Part Lots 12 & 13, DP 1100005;
- Lots 91 &92, DP 1138554; and
- Part Lot 6, DP 237936.

The subject site is located 3 km from the Branxton Town Centre and is situated within Singleton Local Government Area (LGA). It has frontage to Standen Drive and New England Highway but access is via Standen Drive only.

### *1.2.1 Regional Context*

The subject site is located in Lower Belford, which is approximately central to Singleton, Cessnock and Maitland within the Central Hunter. On a broader landscape scale (see **Figure 1.2**), Lower Belford is situated within the Central Hunter valley floor; a largely cleared belt of land that runs south-east to north-western, terminating at the central coast around Newcastle. This section of the Hunter Valley floor is flanked by the hilly ranges of Yengo National Park to the south west (about 20km distant) and Barrington Top National Park to the north-east (over 40 km distant).

The Lower Belford area is typical of much of the Hunter Valley landscape, which is largely cleared as a result of a number of land uses such as agriculture (e.g. dairy farming, crop farming, cattle, horse breeding and viticulture), industry (e.g. mining and support industries) and forestry. The Hunter Valley floor features many gentle rises and gullies that are still lightly vegetated with remnant forest and woodland; however, the remnant vegetation in this landscape is highly fragmented and relatively young. Despite its pastoral context, there are a number of more heavily vegetated areas within the locality of Lower Belford that are protected within formal reserves, including Werakata National Park and Belford National Park. Belford National Park is immediately west of the subject site and was recently a state forest. The holdings to the immediate north of Belford National Park contain vegetation contiguous with the National Park and are in the control of Belford Land Corporation.

### *1.2.2 Description of the Environment*

The subject site consists of gently undulating land that has been historically used for farmland and forestry operations for many years. Current land practices include low-density cattle-grazing and understorey maintenance including weed control. The vegetation of the subject site is largely comprised of unimproved grasslands with scattered trees but supports areas of relatively intact open forest and woodland in gully lines and on gentle slopes (**Figure 1.1**). When studied in the context of its neighbouring properties, it is apparent that the forest and woodland on site comprises a number of remnant patches on the eastern fringe of a large patch of forest and woodland contained within the Bell Road/Standen Drive loop (see **Figure 1.2**).

The topography of the site is marked by a north-south ridgeline that offsets the western boundary and attains a height of about 102 metres. The site has an approximate 1:10 slope in some areas and falls away from the ridgeline to the west into the adjoining property and Belford National Park; most of the land slopes to the east to Standen Drive. The east-facing slopes occupy the majority of the site and are characterised by a series of gentle spurs and gullies, giving rise to a network of ephemeral drainage lines that flow east and south-east into a number of farm dams and towards the road (**Figure 1.3**).

## 1.3 Relevant Legislation

### *1.3.1 Commonwealth Environmental Protection and Biodiversity Conservation Act 1999*

Approval from the Commonwealth Minister for the Environment is required under the EPBC Act if an action, which includes a development, project or activity, will have, or is likely to have a significant effect on matters of NES. These matters include:

- Nationally threatened species and ecological communities;

- Ramsar wetlands;
- Migratory species;
- Heritage items or places that are listed under the Act;
- Commonwealth marine areas; and
- Nuclear actions.

If the proposed action will or is likely to have a significant impact on NES matters, the proponent is required to make a "referral" to the Department of Sustainability, Environment, Water, Population and Communities (SEWPaC). SEWPaC will then determine whether the impact is likely to be significant. If the action is determined to be likely to have a significant impact on NES matters, the action is declared a "controlled action" and additional assessments will be required to gain approval from the Commonwealth Minister for the Environment.

### *1.3.2 NSW Environmental Planning and Assessment Act 1979*

The EP&A Act is the overarching planning document for NSW. This Act provides for the creation of planning instruments that guide land use. The Act also provides for the consideration of biodiversity values, which is addressed in Section 5A (Significant effect on species, populations or ecological communities or their habitats). The Act requires that an "Assessment of Significance" under Section 94A of the TSC Act, also known as the "Seven-Part Test", is undertaken in relation to species, communities, habitat and processes listed under either the TSC Act or the *Fisheries Management Act 1994* (FM Act).

Assessments of Significance are not legally required for a rezoning application; however, indicative assessments of significance have been provided in this report (**Appendix F**) as a risk assessment for the proposal.

### *1.3.3 NSW Threatened Species Conservation Act 1995*

The TSC Act aims to protect and encourage the recovery of threatened species, populations and communities that are listed under the Act, through threat abatement and species recovery programs.

The TSC Act requires consideration of whether a development (Part 4) or an activity (Part 5) is likely to significantly impact threatened species, populations, communities or their habitat. The potential impacts of any developments, land use changes or activities would need to undergo an assessment of significance to determine the need for a Species Impact Statement (SIS). SISs are prepared to examine in detail impacts upon threatened biota and are prepared according to Section 109 and 110 of the TSC Act and the project specific requirements of the Director General of DECCW.

### 1.3.4 Native Vegetation Act 2003

The *Native Vegetation Act 2003* regulates the clearing of native vegetation on all land zoned rural or rural residential, including land zoned Environmental Living within the Singleton LGA, and is administered by the Catchment Management Authority (CMA). The objectives of the Act are to:

> *(a) to provide for, encourage and promote the management of native vegetation on a regional basis in the social, economic and environmental interests of the State, and*
>
> *(b) to prevent broad scale clearing unless it improves or maintains environmental outcomes, and*
>
> *(c) to protect native vegetation of high conservation value having regard to its contribution to such matters as water quality, biodiversity, or the prevention of salinity or land degradation, and*
>
> *(d) to improve the condition of existing native vegetation, particularly where it has high conservation value, and*
>
> *(e) to encourage the revegetation of land, and the rehabilitation of land, with appropriate native vegetation.*

Under the Act, clearing of native vegetation is not permitted without consent and consent cannot be granted unless the clearing in question can improve or maintain environmental outcomes.

### 1.3.5 Fisheries Management Act 1994

The threatened species Schedules of the *Fisheries Management Act* 1994 comprise lists of endangered species, populations and ecological communities, vulnerable species, species presumed extinct and key threatening processes. These Schedules indicate that the Hunter River drainage basin is outside the known distribution of species, populations and ecological communities listed under this legislation. Therefore, none of the listed species, populations or ecological communities is expected to occur on the subject site.

### 1.3.6 State Environmental Planning Policy No. 44 – Koala Habitat Protection (SEPP 44)

Within NSW, the conservation of the Koala has been legislated through the provision of *State Environmental Planning Policy (SEPP) 44 – Koala Habitat Protection* (SEPP 44). SEPP 44 aims to encourage the proper conservation and management of areas of natural vegetation that provide habitat for koalas (Department of Planning, 1995).

Singleton is identified on Schedule 1 of SEPP 44 as an LGA to which this instrument applies. In accordance with this SEPP, it must be ascertained whether the subject site contains Potential Koala Habitat; if so, whether the subject site then contains Core Koala Habitat. SEPP 44 defines Potential and Core Koala Habitat as follows:

- *"Potential koala habitat" means areas of native vegetation where the trees of the types listed in Schedule 2* (see **Table 1.1**) *constitute at least 15% of the total number of trees in the upper or lower strata of the tree component; and*

- *"Core koala habitat" means an area of land with a resident population of koalas, evidenced by attributes such as breeding females (that is, females with young) and recent sightings of and historical records of a population.*

If it is determined that core koala habitat exists on the subject site, then a Koala Plan of Management will need to be prepared for the land before development consent can be granted by the approving authority.

**Table 1.1 LISTED KOALA FEED TREE SPECIES (SEPP 44 – SCHEDULE 2)**

| Scientific Name | Common Name |
|---|---|
| *Eucalyptus tereticornis* | Forest red gum |
| *Eucalyptus microcorys* | Tallowwood |
| *Eucalyptus punctata* | Grey Gum |
| *Eucalyptus viminalis* | Ribbon or manna gum |
| *Eucalyptus camaldulensis* | River red gum |
| *Eucalyptus haemastoma* | Broad leaved scribbly gum |
| *Eucalyptus signata* | Scribbly gum |
| *Eucalyptus albens* | White box |
| *Eucalyptus populnea* | Poplar box |
| *Eucalyptus robusta* | Swamp mahogany |

*i. NSW Recovery Plan for the Koala*

In addition to the SEPP, a State-wide Koala Recovery Plan (DECC (NSW), 2008) has been prepared that details the current status of Koalas in NSW and outlines the actions that are required to aid the recovery of the species. The Recovery Plan identifies the loss and degradation of habitat as being the most significant threat to the species, particularly that associated with agriculture and urban expansion (DECC (NSW), 2008).

a. Assessing Koala Habitat

The Recovery Plan provides definitions for the categorisation of koala habitat based on the presence and abundance of known food tree species. The categorisation of koala habitat

serves to aid the assessment of koala habitat value by ranking koala habitat as Primary, Secondary (Class A, B, C) or Tertiary koala habitat. There are two options for the categorisation of habitat and they follow either Phillips (2000) or Callaghan (unpublished).

The Recovery Plan defines different management regions within NSW called Koala Management Areas (KMA) for which typical primary, secondary and supplementary koala food tree species are listed. The subject site falls within Koala Management Area (KMA) 2: Central Coast/Sydney Basin and the typical feed tree species known for this area is shown in **Table 1.2**.

**Table 1.2 FEED TREE SPECIES COMMON TO KMA 2: CENTRAL COAST/SYDNEY BASIN**

| Feed Tree Species | Common Name |
|---|---|
| **Primary** | |
| *Eucalyptus parramattensis* | Parramatta red gum |
| *Eucalyptus tereticornis* | Forest red gum |
| *Eucalyptus robusta* | Swamp mahogany |
| *Eucalyptus microcorys* | Tallowwood |
| *Eucalyptus amplifolia* | Cabbage Gum |
| *Eucalyptus viminalis* | Ribbon Gum |
| **Secondary** | |
| *Eucalyptus camphora* | Broad-leaved Sally |
| *Eucalyptus conica* | Fuzzy Box |
| *Eucalyptus consideniana* | Yertchuk |
| *Eucalyptus dwyeri* | Dwyer's red gum |
| *Eucalyptus glaucina* | Slaty red gum |
| *Eucalyptus goniocalyx* | Bundy |
| *Eucalyptus largeana* | Craven grey box |
| *Eucalyptus maidenii* | Maiden's gum |
| *Eucalyptus michaeliana* | Brittle gum |
| *Eucalyptus macrocarpa* | Western grey box |
| *Eucalyptus notablis* | |
| *Eucalyptus ovata* | Swamp Gum |
| *Eucalyptus praecox* | Brittle gum |
| *Eucalyptus quadrangulata* | White-topped box |
| *Eucalyptus resinifera* | Red mahogany |
| *Eucalyptus rudderi* | Rudder's box |
| *Eucalyptus scias* | Large-fruited red mahogany |
| *Eucalyptus punctata* | Grey gum |

**Table 1.2 FEED TREE SPECIES COMMON TO KMA 2: CENTRAL COAST/SYDNEY BASIN**

| Feed Tree Species | Common Name |
|---|---|
| *Eucalyptus cypellocarpa* | Monkey gum |
| *Eucalyptus longifolia* | Woollybutt |
| *Eucalyptus baueriana* | Blue box |
| *Eucalyptus bosistoana* | Coast grey box |
| **Stringybarks/Supplementary** | |
| *Eucalyptus agglomerata* | Blue-leaved stringybark |
| *Eucalyptus eugenioides* | Thin-leaved stringybark |
| *Eucalyptus globoidea* | White stringybark |
| *Eucalyptus muelleriana* | Yellow stringybark |
| *Eucalyptus cannonii* | Red stringybark |
| *Eucalytpus prominula* | |
| *Eucalyptus sparsifolia* | Narrow-leaved stringybark |
| *Eucalytpus imitans* | |
| *Eucalyptus oblonga* | |
| *Eucalyptus ralla* | |
| *Eucalyptus tenella* | |
| *Eucalyptus ligustrina* | Privet-leaved stringybark |
| *Eucalyptus capitellata* | Brown stringybark |
| *Eucalyptus camfeldii* | Heart-leaved stringybark |
| *Eucalyptus bensonii* | |
| *Eucalyptus blaxlandii* | |

### *1.3.7 Singleton Land Use Strategy 2008*

The purpose of the Strategy is to review land use across the LGA, review key drivers including growth, conservation and employment and incorporate recent servicing advice. It sets out to establish a framework to guide growth in the short and medium term in the Singleton LGA.

The Strategy confirms the suitability of the Lower Belford Candidate Area for rural residential development. It proposes a minimum lot size of 8,000 $m^2$ with an average lot size of 1 hectare; and the provision of reticulated water services. The Strategy objectives pertaining to large lot rural residential developments are to:

*Provide opportunities for additional rural residential subdivision and development in suitable locations, and enable a range of different types of rural residential development;*

*Ensure that adequate services are available for rural residential lots;*

*Ensure that the supply of zoned rural residential land does not unreasonably exceed demand;*

*Apply criteria to identify the best location for rural residential estates and balance socio- economic goals associated with new rural residential development with the needs to preserve areas of high agricultural, scenic or environmental value*

### *1.3.8 Singleton Local Environmental Plan (LEP) 1996*

The statutory local planning instrument applicable to the subject site is the Singleton LEP. This rezoning application seeks to amend the existing 1(a) – Rural zone to 7(b) – Environmental Living zone, to reflect the current and predicted population growth and subsequent demand for housing in the area.

The objectives of the 1(a) – Rural zone as stipulated in the LEP are to:

*(a) to protect and conserve agricultural land and to encourage continuing viable and sustainable agricultural land use,*

*(b) to promote the protection and preservation of natural ecological systems and processes,*

*(c) to allow mining where environmental impacts do not exceed acceptable limits and the land is satisfactorily rehabilitated after mining,*

*(d) to maintain the scenic amenity and landscape quality of the area,*

*(e) to provide for the proper and co-ordinated use of rivers and water catchment areas,*

*(f) to promote provision of roads that are compatible with the nature and intensity of development and the character of the area.*

The objectives of the 7(b) – Environmental Living zone as stipulated in the LEP are to:

*(a) to provide for low-impact residential development in areas with special ecological, scientific or aesthetic values,*

*(b) to ensure that residential development does not have an adverse effect on those values,*

*(c) to ensure development maintains and contributes to the character of the locality and minimises disturbance to the land,*

*(d) to protect, enhance and manage riparian corridors to facilitate species movement and dispersal and maintain the integrity of banks of watercourses,*

*(e) to encourage rehabilitation and conservation of environmentally important land.*

## 1.4 Terms and Abbreviations

This report uses the following terms and abbreviations:

| | |
|---|---|
| **CMA** | Catchment Management Authority; |
| **DECCW** | Department of Environment, Climate Change and Water; |
| **EP&A Act** | *Environmental Planning and Assessment Act 1979*; |
| **EPBC Act** | *Environment Protection and Biodiversity Conservation Act 1999*; |
| **FM Act** | *Fisheries Management Act 1994*; |
| **LEP** | Local Environmental Plan; |
| **LGA** | Local Government Area; |
| **NV Act** | *Native Vegetation Act 2003*; |
| **NW Act** | *Noxious Weeds Act 1993*; |
| **SEPP 44** | *State Environmental Planning Policy No. 44 – Koala Habitat Protection*; |
| **SEWPaC** | Department of Sustainability, Environment, Water, Population and Communities (formerly DEWHA); |
| **Subject Site** | The site proposed for rezoning, referred to as "Murray's Rise"; |
| **TSC Act** | *Threatened Species Conservation Act 1995*. |

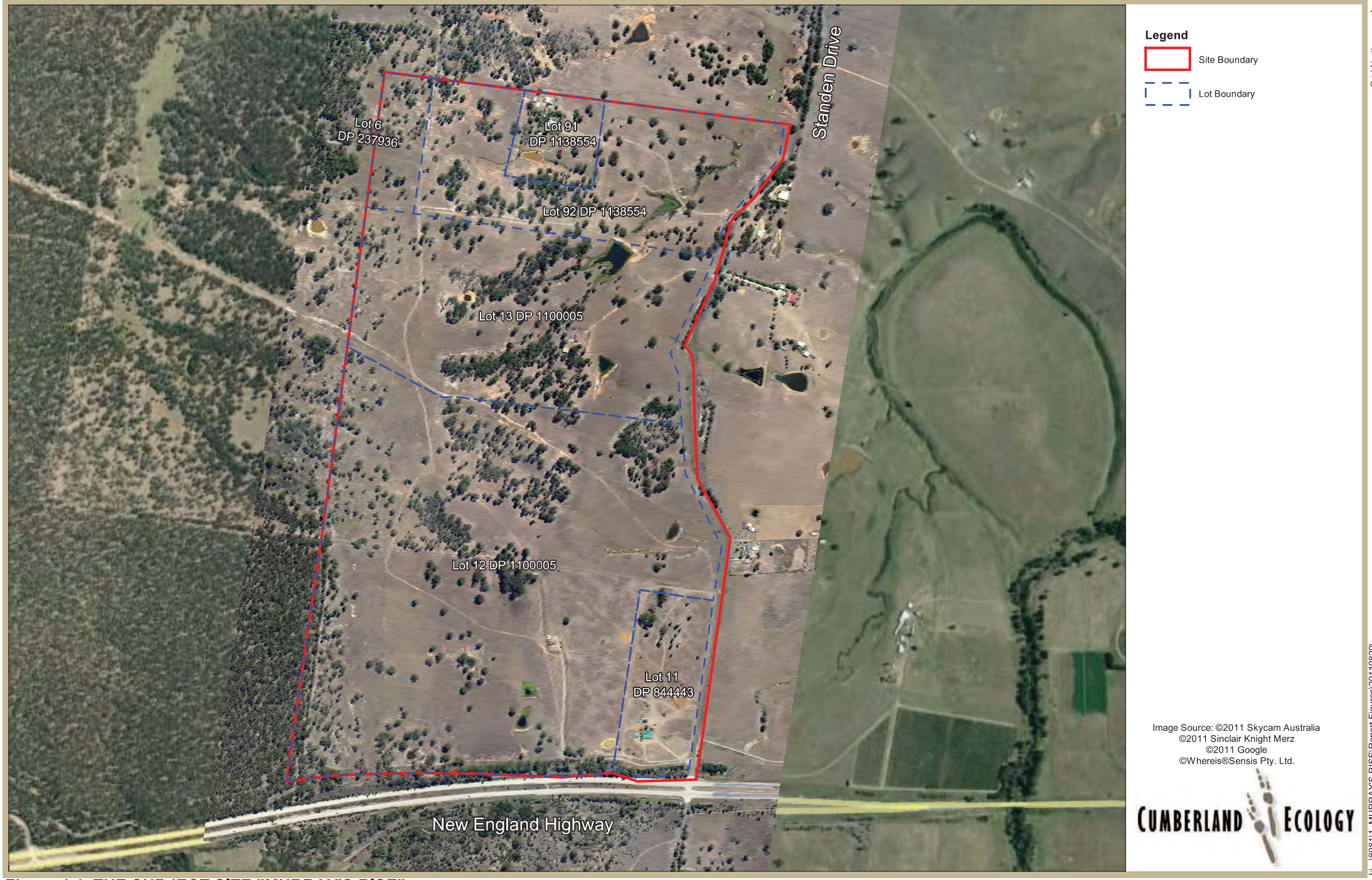


**Figure 1.1. THE SUBJECT SITE "MURRAY'S RISE"**


**Figure 1.2 SITE CONTEXT**


**Figure 1.3. SITE TOPOGRAPHY**

Chapter 2

METHODOLOGY

# Methodology

## 2.1 Desktop Review

Information on the biodiversity and environmental characteristics of the subject site and its surrounds were reviewed where possible. This includes previous vegetation mapping efforts; aerial photography; topographical and hydrological information; threatened species records from agency databases; and plans of management for nearby parks and reserves.

### *2.1.1 Vegetation Mapping*

The vegetation of the subject site has been mapped as part of a larger mapping project conducted by the Hunter-Central Rivers CMA (Peake, 2006). The other regional mapping project covering the Lower Hunter Valley is part of the Lower Hunter & Central Coast Regional Management Strategy (LHCCREMS) (LHCCREMS, 2003). Lower Belford is within close proximity to the northern extent of the LHCCREMS project area but is not covered by the LHCCREMS mapping. The technical reports and the vegetation maps of both mapping projects were studied in detail to gain an understanding of the vegetation types recorded within and surrounding the subject site.

### *2.1.2 Plans of Management*

The Belford National Park draft Plan of Management (NPWS NSW, 2009) was also reviewed as the vegetation and consequently the flora and fauna habitat on the subject site appears to be roughly contiguous with the vegetation of the National Park.

### *2.1.3 Database Records*

Other existing information on the biodiversity values of the subject site and its surrounds were obtained through the consultation of the Department of Environment, Climate Change and Water's (DECCW) Atlas of NSW Wildlife database (DECCW, 2011) and SEWPaC EPBC Protected Matters Search Tool (DSEWPC, 2011). The number and age of records of threatened species recorded within the Singleton LGA were useful supplementary information when assessing the likelihood of threatened species using the habitat within the subject site.

## 2.2 Field Survey Dates

Cumberland Ecology conducted flora and fauna surveys to comply with standards provided in the DECCW '*Threatened Biodiversity Survey and Assessment Guidelines for Development and Activities*'.

A preliminary site inspection was conducted over one day in December 2008 in which a number of floristic samples were collected and a habitat assessment was completed. This work was followed up by bat surveys that were conducted over three nights from the 27th to 30th April 2009.

The results of the above preliminary work were used to guide further flora and fauna surveys that were completed over a period of a week from the 24th – 28th January 2011.

### *2.2.1 Prevailing Weather Conditions*

A summary of weather conditions in the locality of the subject site are provided in **Table 2.1**. Prevailing weather conditions during the 2009 surveys were cool and mild with maximum daily temperatures of 27.7 °C and minimum temperatures of 7.0 °C. Weather conditions for the survey period had become somewhat cooler with the daily maximum temperature varying from 18.7 °C to 22.0 °C and daily minimum temperature ranging from 3.7 °C to 11.0 °C. The prevailing weather during the recent 2011 surveys was very hot and dry, reaching 43.1 °C by mid-week.

Rainfall was minimal in the 2 weeks prior to both survey periods, and conditions remained relatively dry throughout both survey periods.

**Table 2.1 GENERAL WEATHER CONDITIONS FOR 2009 AND 2011 SURVEYS**

| Date | °C min | °C max | Rain (mm) |
|---|---|---|---|
| 27/04/2009 | 9.4 | 18.7 | 0 |
| 28/04/2009 | 4.8 | 22 | 0 |
| 29/04/2009 | 3.7 | 18.9 | 0 |
| 30/04/2009 | 11 | 19.3 | 0.6 |
| | | | |
| 24/01/2011 | 14.5 | 35.9 | 0 |
| 25/01/2011 | 19.2 | 37.4 | 0.2 |
| 26/01/2011 | 19.4 | 43.1 | 0 |
| 27/01/2011 | 24.2 | 36.8 | 0 |
| 28/01/2011 | 22.2 | 26.2 | 0.8 |

*Source: Bureau of Meteorology daily weather observations from Cessnock Airport {station 061260}*

## 2.3 Floristic Survey

### *2.3.1 Data Collection*

Quadrat samples were collected and random meander surveys were undertaken to characterise the vegetation of the subject site and to search for threatened plant species.

A total of 25 quadrats were sampled over representative areas of each vegetation type, including exotic and native grasslands. Of these, 18 were collected within the subject site and the remainder were collected in the adjacent private holding to the west, also owned by Belford Land Corporation. The quadrat dataset is included in this report and can be found in **Appendix A**.

The locations of these quadrats were chosen so that sampling was conducted in areas most representative of the condition and composition of the vegetation patch. Grassland data was also collected to ascertain the condition of the cleared areas. These quadrat locations are shown in **Figure 2.1**.

In each quadrat, the following information was recorded as a minimum:

- All vascular flora species present within the plot or directly adjacent to the plot;
- The stratum in which each species occurred;
- The relative frequency of occurrence of each plant species;
- Vegetation structural data (i.e. height and percentage cover of each stratum);
- Quadrat information including aspect and slope;
- A waypoint to mark the location of the quadrat, using a handheld GPS; and
- Photographs of the quadrat.

The relative abundance and cover of each species within the quadrat was approximated using a scoring system based on the Braun-Blanquet scoring system (Braun-Blanquet, 1927). The scores used are provided in **Table 2.2** below.

**Table 2.2 MODIFIED BRAUN-BLAUNQUET COVER-ABUNDANCE SCORES**

| Class | Cover-abundance | Notes |
|---|---|---|
| + | Rare (less than 1% cover) | Herbs, sedges and grasses: within 4m2<br>Shrubs and small trees: less than 5 individuals |
| 1 | Few Individuals (less than 5% cover) | Herbs, sedges and grasses: within 20m2<br>Shrubs and small trees: 5 or more individuals<br>medium - large overhanging tree |

**Table 2.2 MODIFIED BRAUN-BLAUNQUET COVER-ABUNDANCE SCORES**

| Class | Cover-abundance | Notes |
|---|---|---|
| 2 | 5 - less than 25% cover | - |
| 3 | 25 - less than 50% cover | - |
| 4 | 50 - less than 75% cover | - |
| 5 | 75 - 100% cover | - |

### *2.3.2 Plant Identification and Nomenclature*

All vascular plants recorded or collected were identified using keys and nomenclature provided in Harden (1990-1993). Other references used to assist identification of more cryptic specimens include Richardson *et al.* (2006) and Brooker and Kleinig (1990). Where known, taxonomic and nomenclatural changes have been incorporated into the results, as derived from *PlantNET* (2010). Any specimens that were not readily identifiable were lodged with the National Herbarium of NSW at the Royal Botanic Gardens, Sydney.

### *2.3.3 Dataset Analysis*

Review of the CMA vegetation profiles and vegetation community legal descriptions indicated that vegetation communities in the locality are closely aligned and not readily or distinguishable, since they share many characteristic and/or dominant species. Thus, multivariate analyses were completed on the quadrat dataset collected to obtain statistical support for vegetation community delineation. Statistical procedures were performed on cover abundance score data using PRIMER 6 (v6.1.13) (Clarke and Gorley, 2006).

*i. Classification and Ordination*

To determine the degree of similarity of quadrat samples in terms of species composition, a Bray-Curtis dissimilarity matrix was calculated based on the species abundance data. No transformation was carried out on the raw Braun-Blanquet data, as the metric itself provides an appropriate scaling for reducing the effect of highly abundant species.

To visualise the similarity/dissimilarity of samples in two-dimensional diagram, an ordination analysis was performed on the Bray-Curtis dissimilarity matrix using non-metric multi-dimensional scaling (nMDS). This analysis provided a non-metric diagram of the similarities in species composition among samples, where increasing distance among samples represents increasing dissimilarity in species composition. Where stress values were above 0.15 but less than 0.2, the patterns in the ordination diagram were cross-checked for adequacy by comparing with clustering analyses for consistency (Clarke and Warwick, 2001).

Classification (or cluster analysis) aims to find "natural clusters" of samples within a dataset such that samples within one cluster are more similar to each other than to samples in other clusters (Clarke and Warwick, 2001). Classification analysis was run on the matrix using a hierarchical agglomerative clustering method; this produced a dendogram showing natural clusters of samples based on increasing similarity. The SIMPROF permutation procedure ('Similarity Profiles') was applied to the dendogram to determine statistically significant clusters (Clarke and Gorley, 2006).

No further analysis was completed as the classification and ordination demonstrated a non-significant result (see Chapter 3 for a discussion).

## 2.4 Fauna Survey

### *2.4.1 Spotlighting and Bat Surveys*

To detect nocturnal fauna including Squirrel Glider and microbats, four spotlighting and ultrasonic bat call recording transects ("Anabat" transects) were surveyed over three nights, in remnant vegetation patches (**Figure 2.1**). Transects 3 and 4 were completed concurrently on the third night.

Spotlighting and Anabat recording commenced at dusk and was approximately 1.5-2 hours duration. Survey effort totalled 3-4 person hours per night.

### *2.4.2 Bird Surveys*

Bird census commenced at dawn for two hours each day. Survey effort totalled 4 person hours each day.

An additional survey of approximately 2 person hours took place at dusk on one evening and focused on watering points (i.e. dams).

### *2.4.3 Fauna Trapping*

Four hair tube lines of 10 tubes each were deployed as shown in **Figure 2.1**. These were deployed over four nights. To support hair tube trapping, an additional four arboreal trap lines of 10 Elliott B traps each were also established in remnant vegetation as shown in **Figure 2.1**.

### *2.4.4 General Habitat Assessment*

Fauna habitats were assessed by noting ground, shrub/understorey and canopy cover, number and size of hollows present, habitat features such as bush rock and fallen trees, and signs of fauna usage such as scats and scratches.

Fauna habitat assessments also included consideration of important indicators of habitat condition and complexity including the occurrence of microhabitats such as tree hollows, fallen logs, bush rock and wetland areas such as creeks and soaks. An assessment of the structural complexity of vegetation, the age structure of the forest and the nature and extent of human disturbance throughout the subject site was undertaken and considered.

Hollows are used as a general indication of habitat quality for arboreal fauna, and hollow-dependent birds and bats. Hollows observed during surveys were recorded and the general vegetation condition and tree maturity were used to predict whether trees on site are likely to contain hollows. Indirect indicators of fauna use of the site such as droppings, diggings, footprints, scratches, nests, burrows, paths and runways were also noted.

### *2.4.5 Incidental Observations*

Any incidental vertebrate fauna species that were observed, heard calling, or otherwise detected on the basis of tracks or signs were recorded and listed in the total species list for the subject site. Incidental records of threatened flora and fauna from areas adjacent to the subject site have also been included.

## 2.5 Limitations to Survey

The flora and fauna of the Lower to Central Hunter Valley is relatively well surveyed and understood. The locality surrounding the subject site has been extensively studied and good information exists about the threatened species that have potential to occur. This report has made use of the information available within the DECC Wildlife Atlas and the DEWHA EPBC Protected Matters Search Tool.

Therefore, the use of current surveys combined with literature review and database analysis is likely to be adequate to provide a comprehensive baseline of data against which to consider rezoning of the subject site.

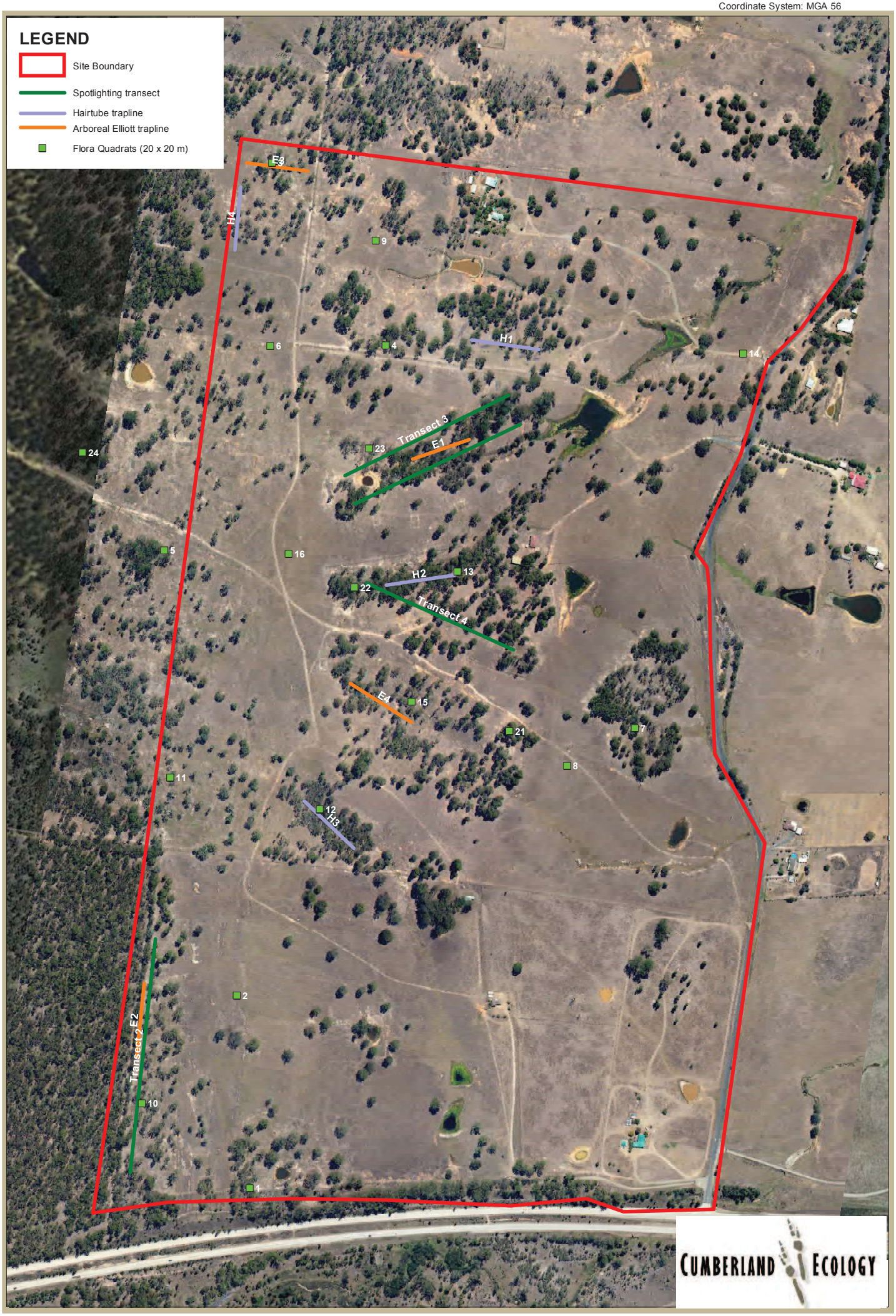


**FIGURE 2.1 SURVEY LOCATIONS**

Chapter 3

RESULTS

# Results

## 3.1 Vegetation Communities

The original vegetation of the subject site is likely to have consisted of continuous forest and woodland communities with no natural grassland areas. However, the subject site has been highly cleared and disturbed since European settlement took place and the extant vegetation now consists of a series of remnant patches of forest and woodland amid grassland areas. Currently, the major patches of remnant vegetation of the subject site largely persists in the gully lines across the site and totals approximately 37 hectares (**Figure 3.1**).

### *3.1.1 Landscape Context*

The site vegetation clearly constitutes a number of peripheral fragmented patches of forest on the eastern fringe of a large block of native forest that encompasses Belford National Park and surrounding properties within the Standen Drive/Bell Road loop (see **Figure 1.2**). The forest in Belford National Park comprises mostly *Central Hunter Ironbark-Spotted Gum-Grey Box Forest.* Within this larger block of vegetation are small inclusions of closely aligned communities; namely *Lower Hunter Spotted Gum-Ironbark Forest*, *Hunter Lowlands Redgum Forest* and *Central Hunter Swamp Oak Forest*, the lattermost of which is typically a gallery forest occurring in the core of streams and creek lines. The former three communities are recognised as Endangered Ecological Communities and are protected under the TSC Act.

The distributions of *Central Hunter Ironbark-Spotted Gum-Grey Box Forest* and *Lower Hunter Spotted Gum-Ironbark Forest* broadly overlap around Branxton and Belford and it is here that the boundaries of these communities are difficult to distinguish, primarily because they occupy similar landscape positions and share many species (Peake, 2006). Additionally, the effects of land use on remnant vegetation can further blur the boundaries between these communities by homogenising characteristic species assemblages and abundances.

### 3.1.2 Site Vegetation Communities

Based on existing mapping of the Hunter Valley (Peake, 2006), the remnant vegetation of the subject site contains *Central Hunter Ironbark-Spotted Gum-Grey Box Forest*, *Lower Hunter Spotted Gum-Ironbark Forest* and *Hunter Lowlands Redgum Forest.* The subject site is situated in the Belford-Branxton transition zone where these communities are difficult to separate. Furthermore, the subject site has undergone varying degrees of long-term modification including canopy thinning, understorey maintenance and weed invasion. This makes it even more difficult to distinguish between the communities.

The classification and ordination of the floristic dataset confirmed that the vegetation was highly similar, with all the sample plots showing at least 50% similarity. The classification analysis yielded a trivial result, showing only a significant separation of woodland and grassland plots but no separation of woodland plots . The dataset also showed a significant seasonal difference in species assemblage and abundance with clear separation of plots collected from different years, a fact which is likely to have confounded the community interpretation of the floristic assemblage. The nMDS plot and classification dendogram are provided in **Appendix E**. As such, it was decided that a best fit of the floristic dataset to the final determination was the most appropriate method for delineating the vegetation communities on site.

The majority of the remnant vegetation conforms best to the final determination for *Central Hunter Ironbark-Spotted Gum-Grey Box Forest* (NSW Scientific Committee, 2010) with a minor presence of *Hunter Lowlands Redgum Forest* at the southern edge of the site (see **Appendix A** for quadrat data). The remainder of the site comprises cleared grassland areas containing lightly scattered regrowth and mature trees. There is a reasonable level of canopy and shrub regrowth on site, particularly on the western boundary. **Table 3.1** summarises the types and proportions of remnant vegetation communities present on the site.

**Table 3.1 VEGETATION PRESENT ON SUBJECT SITE**

| Vegetation Unit | Area (ha) |
|---|---|
| Central Hunter Ironbark-Spotted Gum-Grey Box Forest | 30.5 |
| Hunter Lowlands Redgum Forest | 5.6 |
| Grassland containing scattered trees | 103.9 |
| **Total Area** | **140.0** |

These communities are described in more detail below.

### *3.1.3 Central Hunter Ironbark-Spotted Gum-Grey Box Forest*

**Status:** Endangered Ecological Community (TSC Act)

This is a mid tall open forest typically dominated by Narrow-leaved Ironbark (*Eucalyptus crebra*), Spotted Gum (*Corymbia maculata*) and Grey Box (*Eucalyptus moluccana*). Broad-leaved Ironbark (*Eucalyptus fibrosa*) and/or Forest Red Gum (*Euclayptus teretecornis*) may occasionally dominate or co-dominate. On site, the presence of Narrow-leaved Ironbark, Grey Box and Spotted Gum was largely consistent across the site, occurring as a dominant mix, or co-dominants (**Photograph 3.1**).

On site there is a sparse shrubby understorey including Gorse Bitter Pea (*Daviesia ulicifolia* subsp. *ulicifolia*), Native Blackthorn (*Bursaria spinosa* subsp. *spinosa*) and Coffee Bush (*Breynia oblongifolia*). The ground stratum consists of grasses and herbs including Kangaroo Grass (*Themeda australis*), Wiry Panic (*Entolasia stricta*), Barbed Wire Grass (*Cymbopogon refractus*), Whiteroot (*Pratia purpurascens*), Blue Flax Lily (*Dianella revoluta*), and Pomax (*Pomax umbellata*).

African Olive (*Olea europea* ssp. *cuspidata*) and Lantana (*Lantana camara*) were present on the subject site and are recognised as long term threats to the integrity of this community (NSW Scientific Committee, 2010).

**Photograph 3.1 Central Hunter Ironbark-Spotted Gum-Grey Box Forest**

### *3.1.4 Hunter Lowlands Redgum Forest*

**Status:** Endangered Ecological Community (TSC Act)

This is a mid tall open forest dominated by Forest Red Gum, Narrow-leaved Ironbark and Rough-barked Apple (*Angophora costata*). The community occupies an area at a low point on the southern boundary of the subject site (**Photograph 3.2**).

On site there is a sparse shrubby understorey including Gorse Bitter Pea (*Daviesia ulicifolia* subsp. *ulicifolia*), Native Blackthorn (*Bursaria spinosa* subsp. *spinosa*) and Forest Nightshade (*Solanum prinophyllum*). The ground stratum consists of grasses and herbs including Weeping Grass (*Microlaena stipoides*), Wiry Panic (*Entolasia stricta*), Barbed Wire Grass (*Cymbopogon refractus*), Whiteroot (*Pratia purpurascens*) and Kidney Weed (*Dichondra repens*). The understorey is not dissimilar to that of other forested areas of the subject site.

**Photograph 3.2 Hunter Lowlands Redgum Forest**

### *3.1.5 Grassland*

The grassland areas of the site vary considerably in composition from largely exotic and with few species, to predominantly native with a wide diversity of species. The large proportion of the grassland is dominated by native grasses and is relatively diverse, sharing an array of forb species to that of the forested areas (**Photograph 3.3**). In the west, particularly along the western boundary with Belford National Park, grasslands are essentially the same floristic composition as that described above for the native forest communities.

**Photograph 3.3 Derived Grassland dominated by native grasses**

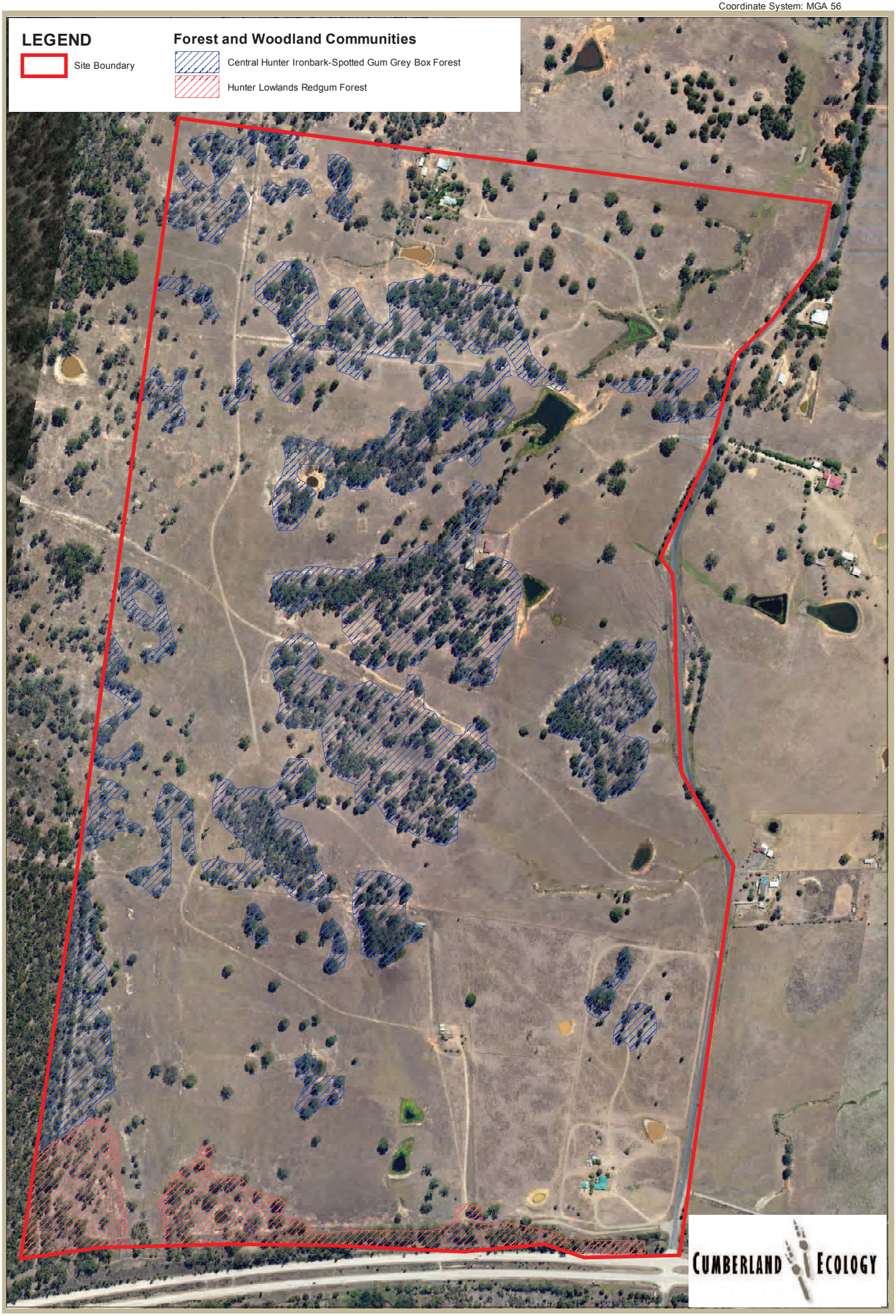


**FIGURE 3.1 FOREST AND WOODLAND COMMUNITIES PRESENT ON THE SUBJECT SITE**

## 3.2 Flora of the Subject Site

A considerable diversity of native plants occurs on the subject site (see species list, **Appendix B**). The canopy assemblage is dominated by species from the Myrtaceae family. The shrub and ground stratum assemblages are dominated by species from the Asteraceae and Fabaceae families, such as *Cassinia* spp., *Daviesia* spp., *Glycine* spp. and *Templetonia* spp.. Many of the species present from the Asteraceae family are common pasture and lawn weeds but a number of the remaining species belonging to Asteraceae are grazing-sensitive species, such as Common Everlasting (*Chrysocephalum apiculatum*) and *Solenogyne bellioides*. Other grazing-sensitive species observed include the ferns *Cheilanthes* spp. and various orchid species (*Caladenia* sp., *Thelymitra* sp., *Microtus* sp.).

### *3.2.1 Noxious Weeds*

A number of exotic weed species were detected on the subject site (**Table 3.2**). Of these, two species are declared a noxious weed for Singleton LGA under the *Noxious Weeds Act 1993* (NW Act). These are *Opuntia aurantiaca* (Tiger Pear) and *Lantana camara* (Lantana). These weeds are present on the subject site in reasonable numbers and are likely to be easily managed in accordance with their respective control requirements (class control requirements are described in the footnotes to **Table 3.2**).

Whilst African Olive is not listed as a noxious weed for Singleton LGA, it is noted that this species will require control to protect and enhance the integrity of existing and future remnant vegetation on the subject site. African Olive and Tiger Pear are reported to be significant risks to the vegetation within Belford National Park (NPWS NSW, 2009) and thus are very relevant to the subject site.

**Table 3.2 WEED SPECIES DETECTED ON THE SUBECT SITE AND THEIR CONTROL CLASSES (NOXIOUS WEEDS ACT 1993)**

| Family | | Scientific Name | Common Name | Control Class^ |
|---|---|---|---|---|
| **SHRUBS** | | | | |
| Cactaceae | * | *Opuntia aurantiaca* | Tiger Pear | 4 |
| Oleaceae | * | *Oleus europaea* subsp. *cuspidata* | African Olive | |
| Rutaceae | * | *Citrus sp.* | A citrus | |
| Verbenaceae | * | *Lantana camara* | Lantana | 4 |
| **DICOT HERBS** | | | | |
| Apiaceae | * | *Cyclospermum leptophyllum* | Slender Celery | |

**Table 3.2 WEED SPECIES DETECTED ON THE SUBECT SITE AND THEIR CONTROL CLASSES (NOXIOUS WEEDS ACT 1993)**

| Family | Scientific Name | Common Name | Control Class^ |
|---|---|---|---|
| Apocyaceae | * *Gomphocarpus physocarpus* | Cotton Bush | |
| Asteraceae | * *Bidens pilosa* | Farmer's Friend | |
| | * *Cirsium vulgare* | Spear Thistle | |
| | * *Conyza bonariensis* | Fleabane | |
| | * *Gamochaeta americanum* | Cudweed | |
| | * *Hypochaeris microcephala* | | |
| | * *Hypochaeris radicata* | Flatweed | |
| | * *Lactuca saligna* | | |
| | * *Lactuca serriola* | | |
| | * *Senecio madagascariensis* | Fireweed | |
| | * *Sonchus oleraceus* | | |
| | * *Tagetes minuta* | Stinking Roger | |
| Brassicaceae | * *Lepidium sp.* | | |
| Caryophyllaceae | * *Paronychia brasiliana* | | |
| | * *Petrorhagia nanteuilii* | | |
| | * *Polycarpon tetraphyllum* | | |
| Fabaceae - Faboideae | * *Trifolium arvense* | | |
| | * *Trifolium* sp. | Clover | |
| Gentianaceae | * *Centaurium erythraea* | | |
| | * *Centaurium tenuiflorum* | Common Centaury | |
| Linaceae | * *Linum trigynum* | | |
| Malvaceae | * *Modiola caroliniana* | Red-flowered Mallow | |
| | * *Sida rhombifolia* | Paddy's Lucerne | |
| Myrsinaceae | * *Anagallis arvensis* | Scarlet Pimpernell | |
| Oxalidaceae | * *Oxalis sp.* | | |
| Plantaginaceae | * *Plantago lanceolata* | | |
| Rubiaceae | * *Richardia humistrata* | | |
| | * *Richardia stellaris* | | |
| Solanaceae | * *Solanum nigrum* | Blackberry Nightshade | |
| | * *Solanum sp.* | | |
| Verbenaceae | * *Verbena bonariensis* | Purple Top | |
| | * *Verbena rigida* | | |

**Table 3.2 WEED SPECIES DETECTED ON THE SUBECT SITE AND THEIR CONTROL CLASSES (NOXIOUS WEEDS ACT 1993)**

| Family | | Scientific Name | Common Name | Control Class^ |
|---|---|---|---|---|
| **MONOCOT HERBS** | | | | |
| Iridaceae | * | *Romulea rosea* | | |
| **GRASSES** | | | | |
| Poaceae | * | *Axonopus fissifolius* | Carpet Grass | |
| | * | *Briza maxima* | | |
| | * | *Chloris gayana* | Rhodes Grass | |
| | * | *Eleusine tristachya* | Crab Grass | |
| | * | *Eragrostis sp.* | | |
| | * | *Eragrostris curvula* | | |
| | * | *Melinis repens* | Red Natal Grass | |
| | * | *Paspalum dilatatum* | Paspalum | |
| | * | *Setaria gracilis* | | |
| | * | *Sporobolus africanus* | Giant Parramatta Grass | |
| | * | *Sporobolus creber* | Slender Rat's Tail Grass | |

*^The relevant control class requirements are:*

*Control class 4 - The growth and spread of the plant must be controlled according to the measures specified in a management plan published by the local control authority and the plant may not be sold, propagated or knowingly distributed; and*

*Control class 5 - The requirements in the Noxious Weeds Act 1993 for a notifiable weed must be complied with.*

## 3.3 Fauna of the Subject Site

The fauna assemblage of the subject site is largely represented by highly mobile species such as birds and bats, with bird diversity being dominated by common urban species (see **Appendix C**). The assemblage observed is typical of many other rural sites and is likely to be a reflection of the fragmented nature of the existing habitat within the context of a rural/urban landscape.

There were relatively low numbers of small ground and arboreal mammals, small woodland birds and reptiles recorded; the under-representation of these groups in the dataset may have been the result of one or a combination of factors, including competition/displacement due to dominance of territorial species; predation/competition

from pest animals; low detectability resulting from the high temperatures experienced during the survey week; and regular maintenance of the site's understorey.

There was a noticeable presence of aggressive and/or territorial species, namely Common Brushtail Possum (*Trichosurus vulpecula*), Noisy Minor (*Manorina melanocephala*) and Grey-crowned Babbler (*Pomatostomus temporalis temporalis*), the latter of which is a Vulnerable species (TSC Act) and is discussed in Section 3.5. Common Brushtail Possum was detected reliably every night during spotlighting surveys and territorial displays were observed in Noisy Minors and families of Grey-crowned Babbler during the day.

Whilst not recorded on site during field survey, a suite of pest animals are known from the area and are likely to frequent the subject site regularly. Species such as the dog (*Canis familiaris familiaris),* European Red Fox (*Vulpes vulpes*), cat (*Felis catus*), Black Rat (*Rattus rattus*) and Indian Mynah (*Acridotheras tristis*) have been recorded in the neighbouring National Park and are likely to be present on the subject site from time to time. The Brown Hare (*Lepus capensis*) was recorded on site and the property is grazed by cattle (*Bos taurus*) most of the year.

There were very high numbers, albeit low diversity of frog species present, which was likely facilitated by the warm weather and the presence of permanent water sources in the form of farm dams. Species like the Eastern Dwarf Tree Frog (*Litoria fallax*) were observed in fringing vegetation at most times of the day. Dams without fringing vegetation still supported high numbers of Broad-palmed Frog (*Litoria latopalmata*) and Peron's Tree Frog (*Litoria peronii*).

## 3.4 Fauna Habitat

### *3.4.1 General Description and Condition*

A high proportion of the subject site has been cleared for pastoral usage and only the gully lines and small areas on the site periphery retain tree cover. The majority of trees are relatively young and thus most lack tree hollows for hollow dependent fauna. The understorey of remnant vegetation is regularly maintained and thus has little structural complexity utilised by woodland birds and small mammals.

The tree cover is also highly fragmented and lacks connectivity with other forest vegetation. Land immediately to the east of the subject site has been cleared and affords little habitat.

Notwithstanding this, the subject site occurs next to Belford National Park. The forest on site occurs in blocks that provide a measure of continuity to each other and provide a stepping stone to other vegetation within Belford National Park (and the vegetated properties to the west of the subject site). Scattered mature trees and small clumps of mature trees provide a stepping stone for more mobile species to other parts of the subject site.

A number of farm dams were also present at the time of survey along drainage lines falling east from the ridgeline at the western boundary of the site. There are some dams near the National Park to the south east of the ridgeline.

Thus, the main types of habitat present on the site can be summarised as being comprised of the following:

- Grassy Woodland/Open Forest;
- Open grassland; and
- Aquatic habitat (farm dams).

There are a number of key habitat features that increase the value of fauna habitat. These were investigated during the current study and included:

- Ground cover, leaf litter, fallen timber and rocky outcrops suitable as shelter for small terrestrial fauna species;
- Well-developed shrub stratum providing suitable habitat complexity as refugia and foraging grounds for small woodland birds and small terrestrial fauna;
- Tree hollows suitable as shelter and breeding habitat for a range of hollow-dependant fauna;
- Blossom-producing trees suitable as forage for a range of nectarivores and feed tree species for other arboreal fauna;
- Mine shafts, wells, culverts and other suitable shelter or breeding habitat for a range of cave-dependant fauna; and
- Ephemeral riparian environments suitable for fauna species dependant on these habitats (e.g. amphibians).

### *3.4.2 Grassy Woodland/Forest Habitat*

*i. Ground cover, leaf litter, fallen timber and rocky outcrops*

Features such as bush rock, fallen logs, leaf litter and ground vegetation, which provide shelter for many of the small to medium sized terrestrial fauna species known from the wider locality were almost completely absent from the subject site. Fallen timber is an important feature for many woodland birds, particularly Brown Treecreeper (*Climacteris picumnus*) and Specked Warbler (*Pyrrholaemus saggitatus*). The wooded parts of the subject site also do not support tall grasses or shrubs in the understorey and therefore provide sub-optimal forage or shelter habitat for most species.

As a result, the types of terrestrial native species using the subject site are likely to be restricted to those that are common and well-adapted to disturbed agricultural areas. Introduced (feral) terrestrial fauna species were observed across the subject site. Foxes (*Vulpes vulpes*) and cats (*Felis catus*) are likely to frequent the site and predation by these species is likely to result in significant pressure on small native terrestrial fauna.

*ii. Understorey Vegetation*

Many native woodland bird species are strongly associated with shrub and tall tussock grass understorey. Understorey vegetation (and thus woodland structural complexity) provides nesting sites, refuge from predators and food (McIntyre et al., 2002). Regular maintenance of the understorey currently takes place across the subject site, which limits the availability of these resources for fauna. During drier periods and other stress periods, these habitats are also likely to be more heavily grazed by stock compared with more productive periods.

*iii. Tree hollows*

The woodland areas within the subject site provide a limited number and diversity of tree hollows for fauna species dependant on this resource as refuge and roosting shelter, and breeding habitat. Notable hollows are shown on **Figure 3.2**. Small hollows in trees within the subject site are likely to provide suitable roosting habitat for common hollow-dependant microbats, such as Gould's Wattled Bat (*Chalinolobus gouldii*) and Chocolate Wattled Bat (*Chalinolobus morio*).

*iv. Blossom-producing and feed trees*

The woodland areas throughout the subject site potentially provide suitable forage habitat for a wide range of nectarivorous birds during blossom periods.

Much of the woodland areas also support a co-dominance or subdominant occurrence of Forest Red Gums (*Eucalyptus teretecornis*) in the canopy stratum, which is one of the primary food tree species for the Koala (*Phascolarctos cinereus*). The site also supports a small number of Grey Box, which is a secondary food tree for Koalas. Cabbage Gum (*Eucalyptus amplifolia*) has been noted in the locality (Cumberland Ecology, 2009) and is also a known feed species for the Koala.

### *3.4.3 Shelter or breeding habitat for cave-dependant fauna*

Habitat assessments indicated that the subject site does not support any significant areas of roosting or breeding habitat for cave-dependant microchiropteran bats. However, buildings within the subject site may provide suitable artificial roosting habitat for a small number of these species, particularly the Eastern Bentwing-bat (*Miniopterus schreibersii oceanensis*), which was detected foraging within the subject site during the survey period.

### 3.4.4 Grassland Habitat

The open grassland areas represent the largest areas of habitat for fauna, totalling approximately 62 hectares. Most of the fauna that utilise this habitat as a foraging resource constitute common birds like Australian Pipit (*Anthus australis*) and Fairy Martin (*Petrochelidon ariel*), or feral mammals like House Mouse (*Mus musculus*), Red Fox (*Vulpes vulpes*) and European Rabbit. The value of the grassland habitat for native fauna like small birds and ground dwelling mammals is diminished as there are very few nearby woodland areas or shrub patches within the open grassland areas for shelter and refuge from predators.

### 3.4.5 Wetland and Aquatic Habitat

Naturally occurring wetlands and permanent streams are absent within the subject site; however there are several farm dams within the subject site that cover approximately 4 hectares of the site. During the survey period some of the dams within the subject site were being deconstructed and drained of water. The dams do not support aquatic or riparian vegetation and are therefore unlikely to provide suitable habitat for most wetland-dependant species. However, suitable habitat for some common amphibian, aquatic reptile and wetland bird species is provided. The water contained within the dams also provides a drinking source for birds and terrestrial mammals.

## 3.5 Threatened Species

### 3.5.1 Threatened Flora Detected

A single individual of Tiger Orchid (*Cymbidium canaliculatum*) was recorded in a Grey Box tree in a paddock at the southern edge of the subject site. This species forms an endangered population in the Hunter Valley. No other individuals were recorded during the survey period but additional numbers are potentially present. Suitable habitat exists on site for this species.

### 3.5.2 Potential Threatened Flora

This section discusses the likely presence of threatened fauna on the subject site. **Table 3.3** below lists the species that have a potential to occur on the subject site based on the the availability of suitable habitat. For a full assessment of the likelihood of occurrence of threatened species known to occur in the locality of the subject, refer to **Appendix D**.

The threatened plant species that have potential to occur on the subject site are small and herbaceous, cryptic and/or deciduous and can persist in grassland areas. The subject site provides suitable habitat for these species but no individuals have been recorded. As the species are highly sensitive to land clearance and other disturbances associated with

agricultural or residential activity, it is unlikely that there are significant occurrences present.

**Table 3.3 POTENTIAL THREATENED FLORA**

| Family | Scientific Name | Common Name | TSC | EPBC |
|---|---|---|---|---|
| Orchidaceae | *Prasophyllum sp. Wybong* | a leek-orchid | | CE |
| | *Pterostylis gibbosa* | Illawarra Greenhood | E1 | E |
| Santalaceae | *Thesium australe* | Austral Toadflax | V | V |

### *3.5.3 Threatened Fauna Detected*

The subject site supports sizeable forest patches dominated by trees that are generally too young to support many hollows. As a consequence the forests of the subject site are not likely to support a high density of hollow dependent fauna. In addition to this, the understorey is unlikely to support a high density and diversity of woodland birds and ground-dwelling mammals.

Notwithstanding the above, some tree hollows do occur and various threatened species have been recorded that are discussed below. There is also potential for the subject site to support some of the smaller forest and woodland birds not recorded on site, such as Speckled Warbler (*Pyrrholaemus saggitatus*) and Diamond Firetail (*Stagonopleura guttata*), because the more extensive habitats of the National Park to the west are likely to support these threatened species and movements between the subject site and the National Park can potentially take place from time to time.

*i. Squirrel Glider (*Petaurus norfolcensis*)*

The Squirrel Glider is listed as vulnerable under the TSC Act. One suspected Squirrel Glider feeding scar was noted on site and a potential sighting was made during spotlighting; the location of the scar and sighting is shown in **Figure 3.2**.

Habitat assessment indicates that most of the woodland on the subject site is able to support Squirrel Gliders, especially during blossom periods for the dominant trees. Furthermore, Squirrel Gliders have been recorded in the forest in Belford National Park and can occasionally move between the National Park and the subject site following foraging resources.

*ii. Microchiropteran Bats*

The following microchiropteran bats were detected during anabat recordings over the survey period. All are Vulnerable species under the TSC Act but are not listed under the EPBC Act.

- Eastern Freetail Bat (*Mormopterus norfolkensis*);
- Little Bentwing Bat (*Miniopterus australis*);
- Eastern Bentwing Bat (*Miniopterus schreibersii oceanensis*); and
- Greater Broad-nosed Bat (*Scotoeanax rueppellii*).

Of the above bat species, the Eastern Bentwing Bat is primarily a cave rooster; the remaining species are known to roost in tree hollows and man-made structures like buildings, culverts and mine shafts. The Little Bentwing Bat is generally found in well-timbered areas.

*iii. Grey-crowned Babbler (*Pomatostomus temporalis temporalis*)*

The Grey-crowned Babbler is a Vulnerable bird species under the TSC Act. A family of Grey-crowned Babbler (numbering eight or nine individuals) were observed daily during the survey period. A number of Babbler nests were also observed throughout the site, with one nest confirmed to be active.

*iv. White-throated Needletail (*Hirundapus caudacutus*)*

The White-throated Needletail is a migratory bird species listed under the EPBC Act. It is a high-flying species, and catches insects and drinks in flight. This species does not breed in Australia but does roost in trees in forest and woodland habitats (DEWHA, 2009). It was recorded flying over the subject site but is not likely to use the site.

The locations of threatened species that were recorded on the subject site are shown in **Figure 3.2**.

Coordinate System: MGA 56


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**FIGURE 3.2 THREATENED SPECIES RECORDED ON THE SUBJECT SITE**

100 0 100 200 300 400 m

### *3.5.4 Potential Threatened Fauna*

The following sections discuss the likely presence of threatened fauna on the subject site. **Table 3.4** below lists the species that have a potential to occur on the subject site based on the proximity and abundance of known records in the wider study area, and the availability of suitable habitat. For a full assessment of the likelihood of occurrence of threatened species known to occur in the locality of the subject, refer to **Appendix D**.

Most of the threatened species with some likelihood of occurring on the subject site are not likely to rely on the site for foraging, roosting or nesting. Due to the regular maintenance of the subject site, including timber removal and maintenance of understorey, as well as the relatively young age of the remnant vegetation, the subject site provides sub-optimal habitat for many species. A general discussion of these species is provided below.

**Table 3.4 POTENTIAL THREATENED FAUNA**

| Family | Scientific Name | Common Name | TSC | EPBC |
|---|---|---|---|---|
| **Aves** | | | | |
| Acanthizidae | *Pyrrholaemus saggitatus* | Speckled Warbler | V | |
| Accipitridae | *Circus assimilis* | Spotted Harrier | V | |
| | *Hieraaetus morphnoides* | Little Eagle | V | |
| Cacatuidae | *Callocephalon fimbriatum* | Gang-gang Cockatoo | V | |
| Climacteridae | *Climacteris picumnus victoriae* | Brown Treecreeper (eastern subspecies) | V | |
| Estrildidae | *Stagonopleura guttata* | Diamond Firetail | V | |
| Meliphagidae | *Grantiella picta* | Painted Honeyeater | V | |
| | *Melithreptus gularis gularis* | Black-chinned Honeyeater (eastern subspecies) | V | |
| | *Xanthomyza phrygia* | Regent Honeyeater | E4A | E, M |
| Neosittidae | *Daphoenositta chrysoptera* | Varied Sittella | V | |
| Petroicidae | *Melanodryas cucullata cucullata* | Hooded Robin (south-eastern form) | V | |
| | *Petroica boodang* | Scarlet Robin | V | |
| Psittacidae | *Glossopsitta pusilla* | Little Lorikeet | V | |
| | *Lathamus discolor* | Swift Parrot | E | E, M |
| | *Neophema pulchella* | Turquoise Parrot | V | |
| Strigidae | *Ninox connivens* | Barking Owl | V | |
| | *Ninox strenua* | Powerful Owl | V | |

**Table 3.4 POTENTIAL THREATENED FAUNA**

| Family | Scientific Name | Common Name | TSC | EPBC |
|---|---|---|---|---|
| **Mammalia** | | | | |
| Dasyuridae | *Dasyurus maculatus* | Spotted-tailed Quoll | V | E |
| | *Phascogale tapoatafa* | Brush-tailed Phascogale | V | |
| Emballonuridae | *Saccolaimus flaviventris* | Yellow-bellied Sheathtail-bat | V | |
| Petauridae | *Petaurus norfolcensis* | Squirrel Glider | V | |
| Phascolarctidae | *Phascolarctos cinereus* | Koala | V | |
| Pteropodidae | *Pteropus poliocephalus* | Grey-headed Flying-fox | V | V |
| Vespertilionidae | *Myotis macropus* | Southern Myotis | V | |
| | *Nyctophilus timoriensis (South-eastern form)* | Greater Long-eared Bat | V | V |

*i. Nectarivorous birds*

The Regent Honeyeater is listed as endangered under the EPBC and TSC Acts. The species commonly inhabits Box-Ironbark Woodland and is a generalist forager feeding on the nectar of a range of eucalypt species. Spotted Gum is an important nectar source for this species during blossoming periods. Spotted Gums within the subject site were budding during the survey period and a moderate abundance of blossom was evident during the additional bird survey. Nonetheless, no Regent Honeyeaters were recorded on the subject site, although there is potential for the species to utilise the food resources of the subject site on an infrequent basis.

The Swift Parrot is listed as endangered under the EPBC and TSC Acts. During the winter the Swift Parrot flies north after breeding in Tasmania, with many individuals migrating to the Hunter Valley during this period. The species forages in areas where eucalypts are flowering profusely or where there are abundant lerp infestations, feeding on the sugary secretions of the lerp. Favoured feed trees include winter flowering species such as Swamp Mahogany (*Eucalyptus robusta)*, Spotted Gum, Red Bloodwood (*Corymbia gummifera)*, Mugga Ironbark (*Eucalyptus sideroxylon)* and White Box (*Eucalyptus albens)*. Commonly used lerp infested trees include Inland Grey Box (*Eucalyptus microcarpa)*, Coast Grey Box (*Eucalyptus moluccana)* and Blackbutt (*Eucalyptus pilularis)*. The presence of lerp and blossom-producing trees within the subject site is likely to result in occasional foraging by Swift Parrots during the winter months; however no individuals of this species were recorded within the subject site during either of the bird survey periods.

The Black-chinned Honeyeater (*Melithreptus gularis*) is listed as vulnerable under the TSC Act. This sedentary species occupies large home ranges, resulting in a semi-nomadic foraging pattern over an extensive area. Although no Black-chinned Honeyeaters were

recorded within the subject site during either of the bird survey periods it is possible that the subject site would constitute a component of the much large home range for this species. It is therefore possible that the Black-chinned Honeyeater may infrequently forage within the subject site during blossom periods of the dominant trees here, despite the absence of records for this species during the survey periods.

*ii. Woodland-dependant birds*

The Speckled Warbler (*Pyrrholaemus saggitatus*), Diamond Firetail (*Stagonopleura guttata*), Hooded Robin (*Melanodryas cucullata*) and Brown Treecreeper (*Climacteris picumnus*) are all listed as vulnerable under the TSC Act. All of these woodland-dependant birds rely heavily on large areas of relatively intact woodland vegetation comprising mixed species of mature and juvenile trees, understorey shrubs and grasses and abundant fallen timber and debris. The subject site has limited habitat complexity for any of these species, and it is unlikely that the site would provide significant habitat for any threatened woodland-dependant birds. However, the occasional occurrence of these species within the subject site while foraging over a much wider area is possible and the Speckled Warbler has been detected in Belford National Park (NPWS NSW, 2009).

*iii. Diurnal and Nocturnal Raptors*

The Square-tailed Kite (*Lophoictinia isura*) and the Powerful Owl (*Ninox strenua*) are both listed as vulnerable under TSC Act. These birds are known from database records to occur in the wider locality, however neither species were recorded within the subject site during the survey period despite targeted efforts.

While not providing roosting or breeding habitat for threatened diurnal or nocturnal raptors, it is considered possible that the subject site provides marginal foraging habitat both of the Square-tailed Kite and the Powerful Owl, and could potentially therefore form a component of a much larger home range for either of these species. The Powerful Owl has been detected in Belford National Park (NPWS NSW, 2009). Given the sub-optimal nature of forage habitat for these birds within the subject site, it is highly unlikely that the site provides significant habitat for either the Square-tailed Kite or the Powerful Owl.

Other threatened owl species – particularly the Masked Owl – have foraging habitat on the subject site and would be expected to forage across the site. Large hollows suitable for nesting appear to be rare or absent.

*iv. Bats*

A number of threatened bat species are known to occur in the wider locality of the subject site. During the survey period, calls that are consistent with those of the vulnerable (TSC Act) Eastern Bent-wing Bat (*Miniopterus schreibersii oceanensis*) were recorded and it is therefore likely that this species forages and possibly shelters within the subject site. Although this species typically roosts in caves, culverts and disused mine shafts, it may also occasionally utilise roof cavities of buildings as shelter habitat. The subject site does

not provide significant habitat for any of the other cave-dependant bats known to occur in the wider locality.

The site also provides potential forage and roosting habitat for the tree-roosting vulnerable (TSC Act) Yellow-bellied Sheathtail-bat (*Saccolaimus flaviventris*) and Southern Myotis (*Myotis macropus*). Southern Myotis was detected in Belford National Park (NPWS NSW, 2009). Although these species were not recorded during the survey period, it is possible that any may infrequently forage in suitable habitat within the subject site during the warmer months of the year, especially as the tree-roosting Eastern Freetail-bat (*Mormopterus norfolkensis*) and Greater Broad-nosed Bat (*Scoteanax rueppellii*) were detected during surveys. However the subject site is unlikely to provide significant shelter habitat for any of these species given the small area of trees with suitable hollows.

The Grey-headed Flying-fox (*Pteropus poliocephalus*) is listed as vulnerable under the EPBC and TSC Acts. This species roosts and breeds in large "camps" consisting of many individuals usually located in dense vegetation. These camps are noisy and conspicuous, and are readily detected during surveys. No camps of the Grey-headed Flying-fox were recorded anywhere within the subject site and it is therefore highly unlikely that the subject site provides suitable roosting or breeding habitat for the Grey-headed Flying-fox. This species is known to forage on a range of food including blossoming and fruiting native trees and shrubs as well as fruit trees in orchards and gardens. Suitable forage for the Grey-headed Flying-fox is abundant throughout the locality and, although this species is likely to forage within the subject site during blossom periods of the dominant trees, the site would not provide significant forage habitat for the Grey-headed Flying-fox.

*v. Other Migratory or Nomadic Birds*

The forest and woodland habitat on the subject site would provide marginal or sub-optimal habitat for migratory species, which typically have very large foraging ranges and prefer large areas of relatively intact woodland vegetation with prolific flowering or prey resources.

*vi. Koala SEPP 44*

The Koala (*Phascolarctos cinereus*) is listed as vulnerable under the TSC Act. No signs of the Koala were recorded within the subject site during the survey period despite targeted efforts including spotlighting and diurnal searches for scratches and scats around known feed tree species.

Most primary koala habitat on the Central Coast and in the Sydney Basin has been cleared. The remaining peri-urban populations are small, highly fragmented and disjunct, occupying areas of secondary (Class B) habitat, which is habitat that can only support a viable, low density population (2000). Most populations are within or on the edge of urban areas and threats are very high (DECC (NSW), 2008).

The subject site contains only one of the primary food tree species listed within Management Area 2 (*Eucalyptus teretecornis*, Forest Red Gum) and does not contain any secondary food tree species. Forest Red Gum occurs on site as a sub dominant canopy species in the woodland and forest areas and comprises less than 30% of the overall overstorey species. According to the Phillips (2000) definition, the site contains Secondary habitat (Class A), which means that is capable of supporting a medium density koala population. Based on the Callaghan (unpublished) definition, the site contains Secondary habitat (Class B), which means that the site is capable of supporting a medium to low density population.

Due to the highly disturbed and fragmented nature of the vegetation within the subject site, it is not considered significant Koala habitat. No Koala scat or tree scratches were identified during habitat assessments. The subject site however could provide suitable wildlife corridors for koalas moving through the landscape to access areas of primary food trees in the wider locality.

*vii. Spotted-tail Quoll (*Dasyurus maculatus*)*

The Spotted-tail Quoll is listed as endangered under the EPBC Act and vulnerable under the TSC Act. No signs of the Spotted-tail Quoll were recorded within the subject site during the survey period, and habitat assessment indicates that the subject site does not provide any suitable shelter, breeding or forage habitat for this species. The Spotted-tail Quoll has been recorded in the wider locality including in Belford National Park (NPWS NSW, 2009) and is known to forage over a wide area as part of a large home range. The occasional rare occurrence of foraging Spotted-tail Quolls within the subject site cannot therefore be completely discounted.

Chapter 4

OPPORTUNITIES AND CONSTRAINTS

# Opportunities and Constraints

## 4.1 Introduction

The purpose of this chapter is to discuss the opportunities for rezoning and future management that would allow the development to take place without significant loss of fauna and flora values. This chapter aims to provide recommendations that can facilitate the preparation of future development applications that avoid the need for Species Impact Statements (SIS) under the TSC Act.

The vegetation and wildlife on site are a significant feature of the landscape that will provide benefits and interest for future occupants if managed appropriately. Moreover, if managed appropriately such remnant vegetation can conserve threatened flora and fauna, maintain or improve linkages to the Belford National Park and other areas.

The main issues for flora and fauna habitat that are to be considered are:

1. Retention of threatened ecological forest communities;
2. Retention of habitat and key habitat features (i.e. tree hollows and dams) for threatened species (bats, birds and arboreal mammals);
3. Maintenance or improvement of connectivity between patches on and off the subject site (particularly to the west into Belford National Park); and
4. Future management of retained habitat.

Considering the points above, three broad areas of the site have been delineated according to relative level of constraint on development. These are referred to within **Figure 4.1** as Areas A, B and C, where Area A represents the highest constraint relative to Area C.

The key items listed above are discussed under the respective headings below.

## 4.2 Vegetation Retention

*The major patches of forest should be conserved on the subject site.*

The remnant vegetation communities on the subject site are endangered ecological communities and are thus protected under the TSC Act and also the NV Act. Retention of the remnant forests on the subject site during future development of the site would avoid significant impacts on threatened communities and thus avoid the need to complete an SIS for future development applications.

There is a good opportunity to locate a lot disturbance footprint of approximately 2,500 $m^2$ on site and retain trees, if careful consideration is given to the lot configuration and the placement of buildings and ancillary structures to avoid trees. In Area A where the majority of the intact forest occurs, building envelopes can be established on the ridgelines in between the vegetated gullies to avoid clearing trees.

Fragmentation of the existing vegetation can also be minimised by assigning larger lots in more sensitive areas including Area A, with the smallest lots occurring in Area C where the majority of the cleared land occurs.

The retention of remnant vegetation would preserve the character of the land for the benefit of future residents of the site, which is also consistent with the objectives of the proposed zoning.

## 4.3 Threatened Species Habitat

*Key features of threatened species habitat should be conserved or enhanced.*

Retention of the majority of forest and woodland on site will retain habitat for flora and fauna. Thus, retention of vegetation as part of the rezoning proposal will be a key measure to manage threatened species that are present on the subject site and minimise impacts due to future development. By conserving forest and woodland habitat, there is opportunity for the proposal to address potential impacts on threatened species by retaining key habitat characters such as:

- Valuable feed trees and sap-feeding trees and shrubs for gliders, koalas, bats and birds;
- Trees supporting existing nest sites, particularly for the Grey-crowned Babbler;
- Understorey and shrub habitat for small mammals and birds to shelter in;
- Hollow-bearing trees and recruitment trees (future hollow-bearing trees);
- Coarse woody debris within woodland remnants; and

- Permanent watering points such as dams, although it is noted that there is currently no permanent streams on the subject site.

The scattered trees in grassland areas currently support at least one individual of the threatened orchid, *Cymbidium canaliculatum*. Hence the retention of the scattered trees would also avoid impact on threatened species also add value to the character of the site. Additionally, it is also recommended that the species is propagated and planted in various locations within Area A and/or in Belford National Park to ensure that any potential impacts on the species on site are adequately mitigated.

## 4.4 Connectivity and Corridors

*Connectivity between patches on site and to areas off site should be maintained or improved if possible.*

The vegetation on the subject site is fragmented and does not connect to surrounding vegetation. There is limited vegetation to the east of Standen Drive; and linkages to the south of New England Highway would be unlikely across a dual carriageway.

However, there is excellent opportunity to establish and maintain a connected vegetated corridor between the subject site and neighbouring properties to the west and to Belford National Park, which would allow for a flow of ecological resources across the broader landscape. This can be achieved by encouraging (or at least not impeding) the regeneration of tree species at a location within Area B, where there is a promising degree of unassisted or natural regeneration of tree species.

There are several options available to the proponent to secure an area of the site for a corridor, including the designation of larger lots over this area with building envelopes located appropriately. Some type of covenant or planning mechanism to preserve the vegetation from clearance could be considered to permanently protect the corridor. A landscape or bushland management plan could also provide for the establishment and protection of a vegetated corridor between the remnant vegetation on site and the vegetation to the west.

The establishment of a corridor will minimise the future impacts to threatened species due to future development. An active re-vegetation proposal for the gully areas could assist in the overall corridor values of the site and lead to an improved environmental outcome for the development project.

## 4.5 Future Management of Retained Vegetation

### *4.5.1 Stormwater and Hard Surface Run-off*

Future development of the site, particularly at the high points of the site (i.e. Area B and the western sections of Area C) will need to be appropriately managed to protect the integrity of the vegetation downslope. Erosion control of the drainage banks and slopes should also be addressed.

### *4.5.2 Vegetation Regrowth*

There is currently a degree of recruitment of tree species in the grassland areas, particularly in Area B and thus the proposal has an opportunity to improve the biodiversity value of the subject site by encouraging the rehabilitation of trees and shrubs on the site, perhaps through implementation of the aforementioned landscape or bushland management plan. This could achieve the following:

- Establish visual screening on the southern boundary;
- Rebuild understorey structure where lacking;
- Increase numbers of suitable food tree species for fauna such as the Koala;
- Increase the total area of habitat available, which will reduce edge effects, minimise foraging distances and increase the types of resources available; and
- Limit/mitigate the developmental impacts (e.g. visual, fragmentation) on the neighbouring National Park.

### *4.5.3 Weed Invasion*

African Olive infestations occur across the forested land on the subject site and this species is a significant threat to the biodiversity of the subject site in the long term. Current management has entailed slashing to control this woody weed and the slashing has apparently controlled the level of infestation across a high proportion of the site. However, African Olive can invade relatively undisturbed forest and seeds are long lived. It is also well established in Belford National Park. Other environmental weeds present on the site include Lantana and Tiger Pear (*Opuntia aurantiaca*), which are also risks to the integrity of the remnant native vegetation on site and in the adjacent National Park.

For this reason, there will need to be ongoing active management of African Olive (and any other environmental weed) to preserve the integrity of the subject site. Appropriate weed management will lead to the improvement of the environmental values of the subject site.

Domestic animals will also need to be controlled to protect the resident wildlife, such as gliders and Grey-crowned Babblers as well as wildlife impacts on the neighbouring National Park.


**Figure 4.1. ECOLOGICAL CONSTRAINTS MAP**

Chapter 5

CONCLUSION

# Conclusion

There is an opportunity to conserve and enhance forest and woodland on the site without significant loss provided the following measures are taken:

- Conserve remnant patches in Area A and B;
- Retain habitat values including tree hollows, feed tree species and understorey structure;
- Establish and maintain vegetated linkage to the National Park and western neighbouring properties;
- Manage weed invasion and domestic animals;
- Manage stormwater and hard-surface run-off; and
- Encourage regeneration of tree and shrub species to improve habitat and biodiversity value of the site.

Future development of the subject site, if carried out in an appropriate manner in conformity with the above measures, will meet the “improve and maintain” test and obviate the need for a Species Impact Statement.

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