

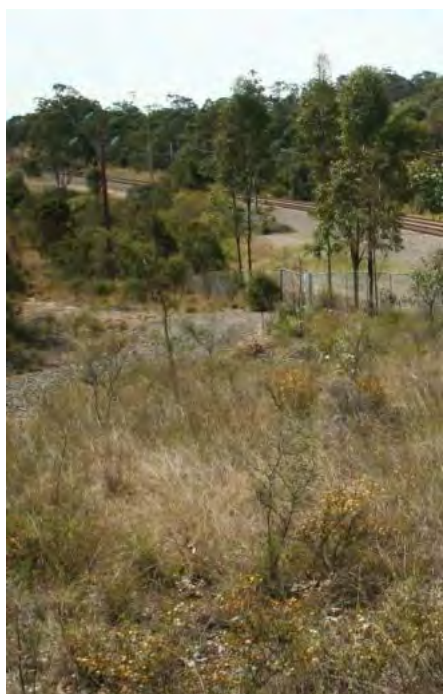


Biodiversity Certification Assessment Report for the Warnervale Town Centre

FINAL

Prepared for
Wyong Shire Council (WSC)

21 March 2012



ADDENDUM

The revised draft zonings shown on Figure 4 - Page 6 of this report were gazetted after this report was completed and now represent the current zonings for the Warnervale Town Centre.

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Contents

| | |
|--|----|
| Contents | ii |
| List of Tables | iv |
| List of Figures | v |
| Abbreviations | vi |
| 1 Introduction | 1 |
| 1.1 Project Background | 1 |
| 1.2 Biodiversity Certification Assessment Area | 1 |
| 1.3 Conditions of Biocertification | 2 |
| 2 Methods | 7 |
| 2.1 Field Assessment | 7 |
| 2.2 Biometric Vegetation Type And Condition Mapping | 9 |
| 2.3 Vegetation Type Descriptions | 12 |
| Blackbutt – Turpentine open forest of the foothills of the North Coast | 12 |
| Smooth-barked Apple - Red Bloodwood open forest on coastal plains on the Central Coast, Sydney Basin | 13 |
| Spotted Gum - Grey Ironbark open forest on the foothills of the Central Coast, Sydney Basin | 14 |
| Swamp Mahogany swamp forest on coastal lowlands of the North Coast and northern Sydney Basin | 15 |
| 2.4 Endangered Ecological Community Mapping | 15 |
| 2.5 Threatened Species Observations | 16 |
| 2.5.1 Wallum Froglet | 16 |
| 2.5.2 <i>Diuris praecox</i> | 17 |
| 3 Biocertification Assessment Results | 19 |
| 3.1 Biodiversity Certification Assessment Area | 19 |
| 3.2 Vegetation Mapping and Zones | 19 |
| 3.3 Landscape Tg Values | 24 |
| 3.4 Transect/Plot Data and Site Value Scores | 24 |
| 3.5 Landscape Score | 27 |
| 3.5.1 Native Cover in Landscape | 27 |

| | | |
|-------|---|----|
| 3.5.2 | Connectivity Value | 27 |
| 3.5.3 | Adjacent Remnant Area | 30 |
| 3.6 | Threatened Species Assessment..... | 30 |
| 3.6.1 | Wallum Froglet | 30 |
| 3.6.2 | <i>Rutidosia heterogama</i> | 30 |
| 3.7 | Red Flags | 30 |
| 3.8 | Indirect Impacts | 32 |
| 3.9 | Credit Calculations..... | 33 |
| 3.9.1 | Ecosystem Credits..... | 33 |
| 3.9.2 | Species Credits | 34 |
| 3.10 | Credit Profiles | 34 |
| 4 | Credit Converter | 38 |
| 4.1 | Estimated Credit Cost..... | 38 |
| | References | 39 |
| | Appendix 1: LHS GIF Assessment..... | 41 |
| | Appendix 2: Species Predicted and Requiring Survey..... | 56 |
| | Species Predicted | 56 |
| | Species Requiring Survey | 57 |
| | Appendix 3: Landscape Tg Calculations | 60 |
| | Appendix 3: Flora Species List..... | 65 |
| | Appendix 5: Transect/Plot Data..... | 76 |
| | Warnervale Town Centre | 76 |
| | Appendix 6: Red Flag Variation..... | 78 |
| | Swamp Mahogany swamp forest | 80 |
| | Avoiding and minimising impacts | 80 |
| | Viability | 80 |
| | Contribution to regional biodiversity values | 82 |
| | Appendix 7: Report on the Use of Certified Local Data Under the Biodiversity Certification Assessment Methodology | 88 |
| | Introduction..... | 88 |
| | Background | 88 |
| | Use of more appropriate local data for <i>Rutidosia heterogama</i> | 88 |
| | Reasons for use of more appropriate local data | 89 |
| | Distribution and status..... | 89 |

| | |
|--|----|
| Regional abundance | 89 |
| Impact caused by biodiversity certification of WTC | 92 |
| Impact requires offsetting | 92 |
| Conclusion | 92 |
| Appendix 8: WTC Credit Calculations | 95 |
| Appendix 9: Credit Converter | 99 |

List of Tables

| | |
|--|----|
| Table 1: Fauna survey effort (adapted from Bell and Murray 2004) | 8 |
| Table 2: Threatened species and ecological communities | 9 |
| Table 3: Biometric Vegetation Type Conversions | 11 |
| Table 4: Land use breakdown | 19 |
| Table 5: Area of vegetation within the BCAA | 20 |
| Table 6: Area of vegetation zones within the BCAA (excluding cleared land) | 20 |
| Table 7: Landscape Tg assigned to each vegetation type | 24 |
| Table 8: Vegetation zones and transect/plot data | 24 |
| Table 9: Site value scores allocated to each vegetation zone | 25 |
| Table 10: Native vegetation in assessment circle | 27 |
| Table 11: Final ecosystem credit results | 34 |
| Table 12: Final species credit results | 34 |
| Table 13: Ecosystem credit profiles | 36 |
| Table 14: DECC LHSGIF Identification “Key Characteristics” | 53 |
| Table 15: Relative Abundance of Swamp Mahogany swamp forest in Surrounding Regions | 84 |
| Table 16: Percent Remaining of Swamp Mahogany swamp forest | 86 |
| Table 17: Native Vegetation Cover of CMA Subregions | 86 |

List of Figures

| | |
|---|----|
| Figure 1: Warnervale Town Centre Biodiversity Certification Assessment Area | 3 |
| Figure 2: Biodiversity Certification Proposal | 4 |
| Figure 3: Current Zoning | 5 |
| Figure 4: Revised Draft Zoning | 6 |
| Figure 5: Survey Effort | 10 |
| Figure 6: Threatened Species Observations and Habitat | 18 |
| Figure 7: Vegetation Types | 22 |
| Figure 8: Vegetation Zones | 23 |
| Figure 9: Vegetation Zones and Transects/Plots | 26 |
| Figure 10: Assessment Circle | 28 |
| Figure 11: Drainage Lines and Buffers | 29 |
| Figure 12: Red flag | 31 |
| Figure 13: Distribution of LHSGIF | 49 |
| Figure 14: Proportion of Diagnostic Spotted Gum-Ironbark Species (NPWS 2000)..... | 51 |
| Figure 15: Proportion of Diagnostic Spotted Gum - Ironbark Species (Bell and Driscoll 2007) | 51 |
| Figure 16: Red flag | 79 |
| Figure 17: Revised draft zoning and Swamp Mahogany Swamp Forest..... | 81 |
| Figure 18: 'Region' Derived from Adjacent CMA Subregions | 83 |
| Figure 19: Relative Abundance of Swamp Mahogany Swamp Forest in Surrounding Regions..... | 85 |
| Figure 20: Native Vegetation Extent in Region | 87 |
| Figure 21: Impact on <i>Rutidosia heterogama</i> Population | 90 |
| Figure 22: Extent of <i>Rutidosia heterogama</i> in Wyong CMA Subregion | 91 |
| Figure 23: Extent of <i>Rutidosia heterogama</i> in HCR CMA Region..... | 94 |

Abbreviations

| ABBREVIATION | DESCRIPTION |
|--------------|---|
| ARA | Adjacent Remnant Area |
| BCAA | Biodiversity Certification Assessment Area |
| BCAM | Biodiversity Certification Assessment Methodology |
| DECCW | Department of Environment, Climate Change and Water (now OEH) |
| DoP | Department of Planning (now Department of Planning and Infrastructure) |
| DP&I | Department of Planning and Infrastructure |
| EEC | Endangered Ecological Community |
| ELA | Eco Logical Australia |
| OEH | Office of Environment and Heritage (formerly DECCW) |
| RFEF | River-Flat Eucalypt Forest on Coastal Floodplains of the New South Wales North Coast, Sydney Basin and South East Corner Bioregions |
| SIC | State Infrastructure levy |
| SIS | Species Impact Statement |
| SSF | Swamp Sclerophyll Forest (Swamp Sclerophyll Forest on Coastal Floodplains of the New South Wales North Coast, Sydney Basin and South East Corner Bioregion) |
| TSPD | Threatened Species Profile Database |
| WEZ | Wyong Employment Zone |
| WSC | Wyong Shire Council |
| WTC | Warnervale Town Centre |

1 Introduction

1.1 PROJECT BACKGROUND

The NSW Office of Environment and Heritage (OEH- formerly the Department of Environment, Climate Change and Water) has recently finalised the methodology to be applied to Biodiversity Certification (Biocertification) applications throughout NSW, known as the Biodiversity Certification Assessment Methodology (DECCW 2011). Eco Logical Australia (ELA) were commissioned by Wyong Shire Council (WSC) to apply the Biodiversity Certification Assessment Methodology (BCAM) to assess the Warnervale Town Centre (WTC) proposed rezoning.

The WTC Biodiversity Certification Assessment Area (BCAA) has been assessed using field and desktop methods, utilising existing information in previous flora and fauna reports, databases and vegetation mapping products where possible. Additional site survey, limited predominantly to biometric vegetation transects/plots and opportunistic threatened species observations, has been undertaken by ELA for this project.

1.2 BIODIVERSITY CERTIFICATION ASSESSMENT AREA

The Warnervale Town Centre BCAA is located on the NSW Central Coast, in the Wyong Local Government Area (Figure 1). The site is located west of Tuggerah Lake, approximately 12 kilometres from the coast. The WTC is 113.4ha in size. It is bounded by Sparks Road in the south, Hakone Road in the north and Hiawatha Road in the east. The site is dissected by the main northern railway.

The BCAA contains two proposed land uses to be assessed (Figure 2):

- Land proposed for biodiversity certification (i.e. development)
- Retained lands (the „Daisy Reserve“ and footbridge located to the west of the railway, which are being considered as part of another development approval and therefore are not considered in this assessment)

It is noted that the land proposed for biodiversity certification (i.e. development) has been identified using a precautionary approach, and as such the area to be biodiversity certified is larger than what will actually be impacted during development.

There are several areas within the land proposed for biodiversity certification where the final land use is proposed to be public recreation or environmentally zoned land (riparian corridors). Although these areas will maintain significant native vegetation and biodiversity value after development, the amount of impact to these areas from services related to the development, such as roads, sewer, cycle ways/pathways and water storage/treatment is currently not known.

The BCAM requires certainty before credits can be generated within „conservation“ lands (such as environmentally zoned land). As the final footprint for these areas is not yet known, this assessment has had to assume impact to these areas, despite the fact that vegetation will most likely remain to some degree. In addition, the BCAM assumes the total loss of biodiversity in areas impacted, and partial loss cannot be calculated. Therefore the areas of public recreation and riparian corridors have been included in „land proposed for biodiversity certification“, with an assumption of total loss, even though significant vegetation will remain after certification.

Those areas likely to retain significant biodiversity value are zoned Environmental Conservation (E2) and Environmental Management (E3). Area zoned Public Recreation (RE1) may retain some biodiversity value. The current zoning layout for the WTC is displayed in Figure 3. A recently revised draft zoning map for the WTC is on publicly exhibition. If approved the new zoning map will replace the earlier map, and is displayed in Figure 4.

Finally, the retained lands identified within the BCAA are associated with the development proposed for North Warnervale Station, including a footbridge to the west of the station and the „Heath Wrinklewort Reserve“ (or Daisy Reserve). Because these lands are part of another development approval they are not considered in this assessment. In addition, the Daisy Reserve has already been used as an offset for the development of North Warnervale Station, and can therefore not be used in the biocertification assessment to offset the impacts of the town centre.

1.3 CONDITIONS OF BIOCERTIFICATION

The information provided in this report outlines the credits required, and generated, on the Warnervale Town Centre Biodiversity Certification Assessment Area, which Wyong Council wishes to Biodiversity Certify under the new Part 7AA of the *Threatened Species Conservation Act 1995*. Biodiversity Certification will only be conferred on land where the Minister makes a determination that the application improves or maintains biodiversity values.

Should Biodiversity Certification be conferred on the WTC BCAA, Section 126I of the *Threatened Species Conservation Act 1995* states that projects carried out on biodiversity certified lands do not require an assessment of the impact of the project on biodiversity values (State Significant Developments under the Planning Act), or are considered not likely to significantly affect any threatened species, population or ecological community, or its habitat (Part 4 and 5 of the Planning Act). Therefore, should this site be biodiversity certified, additional flora and fauna survey, assessment and seven part tests will not be required where development is consistent with the Biodiversity Certification Order (to be drafted).

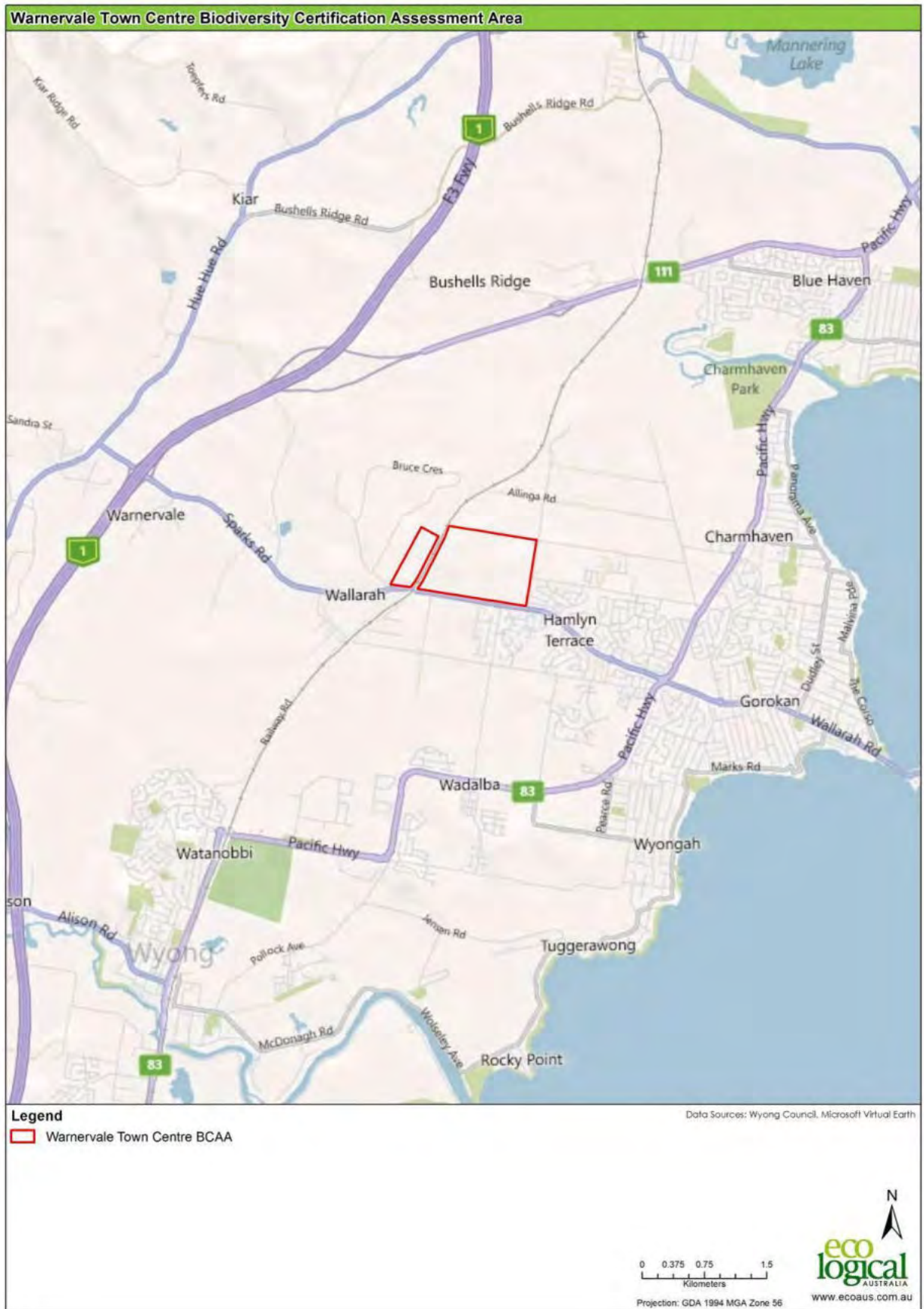


Figure 1: Warnervale Town Centre Biodiversity Certification Assessment Area



Figure 2: Biodiversity Certification Proposal

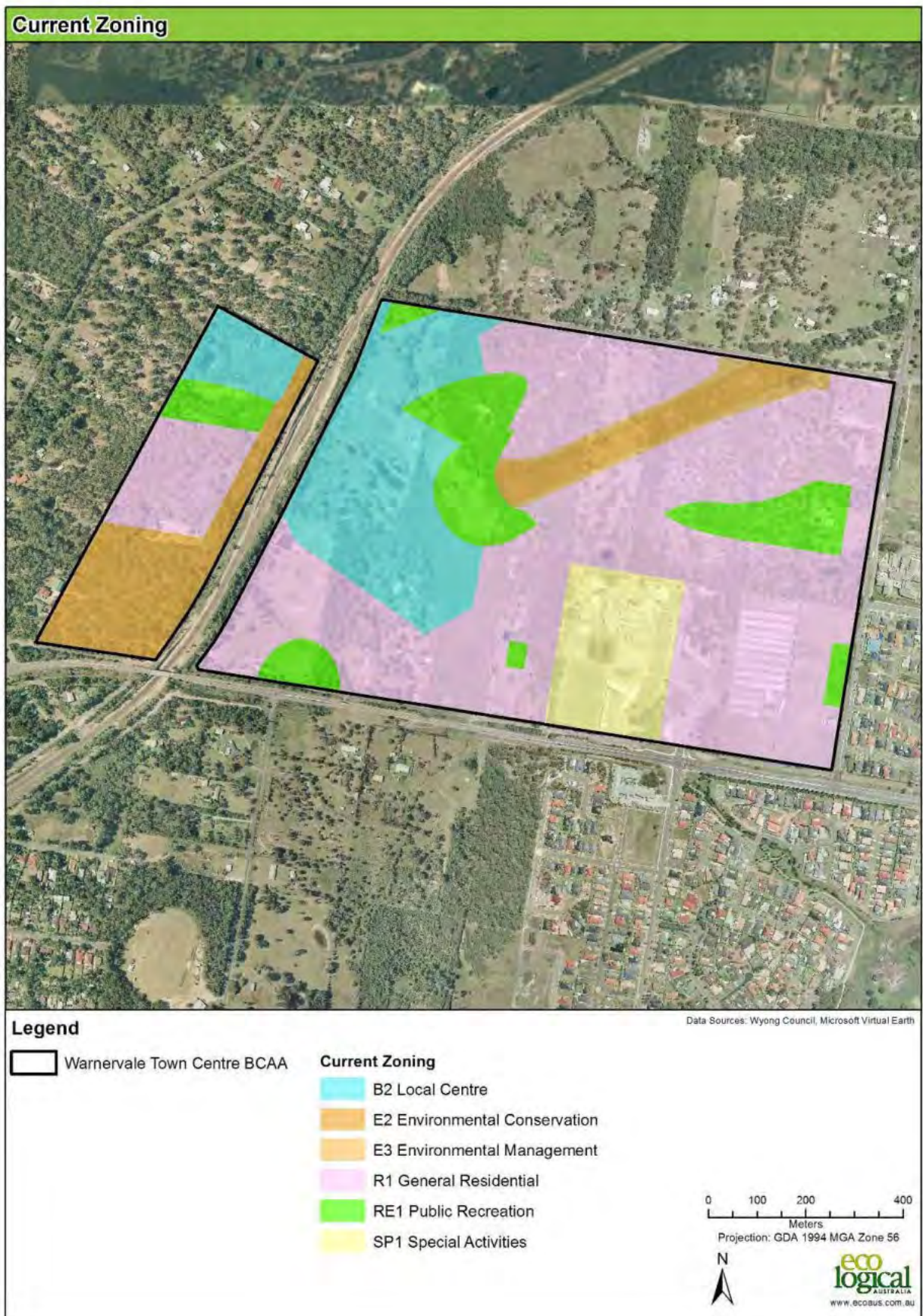


Figure 3: Current Zoning

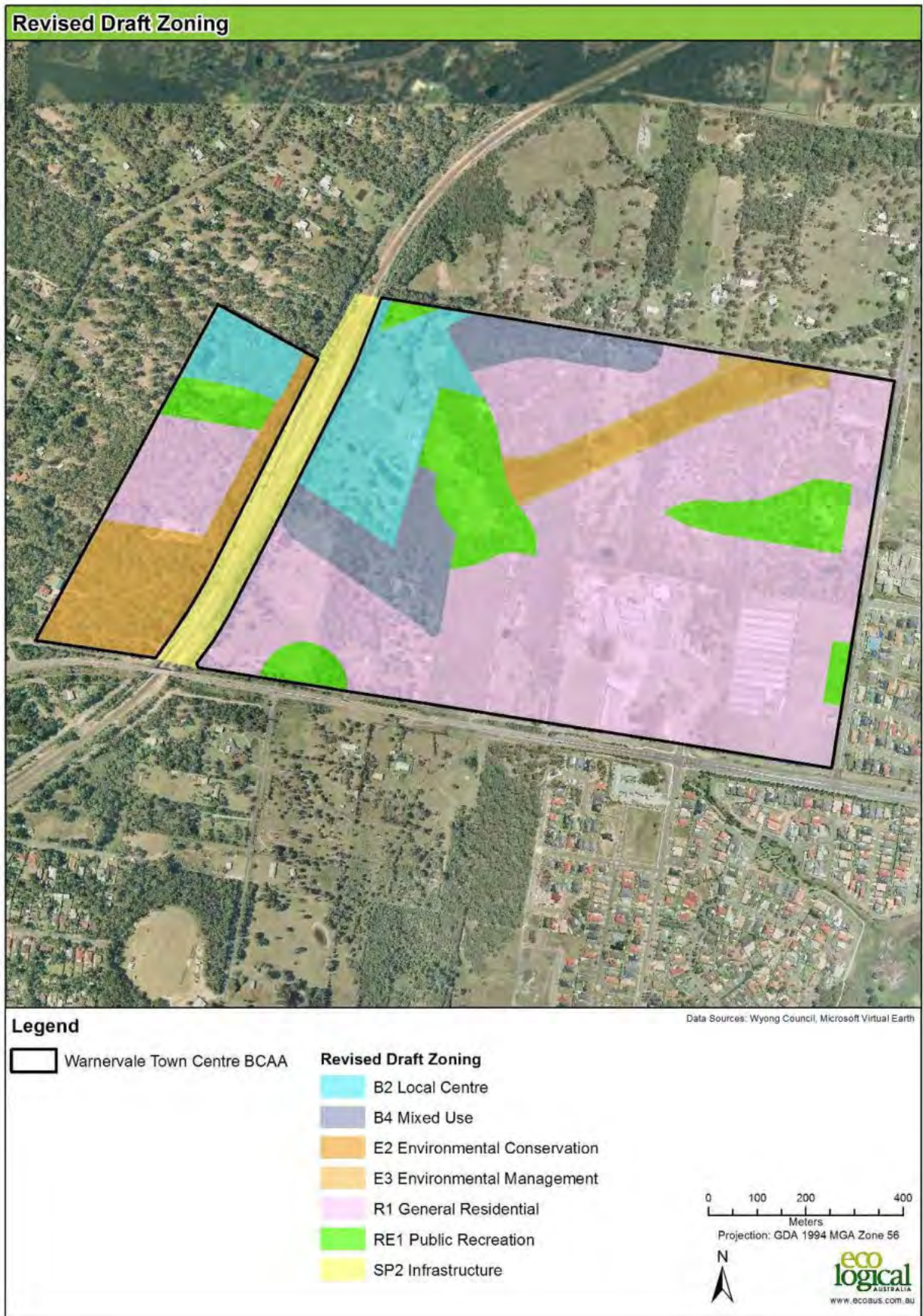


Figure 4: Revised Draft Zoning

2 Methods

2.1 FIELD ASSESSMENT

The WTC BCAA has a long history of previous ecological assessments including studies by Bell and Murray (2004) and ELA (2005, 2008 and 2010). A comprehensive flora and fauna study was undertaken for the study site (Bell and Murray 2004), and included a range of survey techniques including plot and transect based flora surveys, targeted threatened species survey, vegetation mapping, diurnal and nocturnal fauna surveys, trapping and spotlighting.

Bell and Murray (2004) conducted 14 visits to the broader WTC study area (11 of which occur within the Biodiversity Certification Assessment Area) to complete flora surveys, including general reconnaissance, targeted terrestrial orchid surveys, other cryptic species survey and plot based surveys. Surveys included reconnaissance, targeted survey and random meander techniques, with plot data collected undertaken within 0.04ha quadrats (Figure 5). General reconnaissance was conducted on the site in August 2003, whilst targeted flora surveys were conducted between September 2003 and February 2004.

Bell and Murray (2004) also conducted a significant assessment of threatened fauna, with surveys undertaken by targeting the following fauna groups; birds, mammals, reptiles and amphibians. Survey sites were established to sample each fauna habitat type. Three survey sites within the current WTC site were surveyed, along with two other sites that are located outside the current BCAA (Figure 5). Fauna surveys were conducted in October and November 2003.

In addition to the general fauna survey sites Bell and Murray (2004) also conducted targeted fauna surveys for a number of threatened fauna species considered likely to occur within the study area. Surveys completed include (Bell and Murray (2004)):

- *Bird surveys, including diurnal 20 minute census recording all bird species observed or heard at each survey site, opportunistic sampling whilst undertaking other activities and nocturnal census involving quiet listening for calls of nocturnal birds followed by playback of prerecorded calls of threatened owls;*
- *Surveys for the presence of mammals including trapping for small terrestrial and arboreal mammals, spotlighting for terrestrial and arboreal mammals, examination of scratch marks on tree trunks, searches for characteristic diggings, burrows and other indirect evidence including collection of scats and analysis of hair samples collected in hair tubes;*
- *Trapping undertaken at each of the fauna survey sites with Elliott Type A traps (8 x 10 x 33 centimetre) baited with a mixture of peanut butter, rolled oats and honey. At each site, 25 small traps were set for three consecutive nights. In addition, five cage (cat size) traps were also set for three nights;*
- *Arboreal trapping for possums and gliders was undertaken with Elliott Type B (15 x 16 x 45 cm) folding aluminium traps mounted on platforms attached to the tree trunk. Spotlight searches were undertaken by foot at each survey site for 30 - 40 minutes with a 55 watt spotlight, followed by quiet listening in darkness to detect any animal movements or vocalisations.*

Arboreal mammal trapping and spotlight surveys were conducted during the October and November 2003 surveys.

- SEPP 44 (Koala Habitat) Assessment;
- Surveying for the presence of large terrestrial mammals included spotlight searches undertaken by foot at each survey site for 30 - 40 minutes with a 55 watt spotlight, followed by quiet listening in darkness to detect any animal movements or vocalisations. Searches were also conducted of all adjoining bushland areas. Searches for indirect evidence to suggest the presence of a species, including collection of scats, examination of burrows, diggings and hair tube samples;
- Surveys for megachiropteran (flying foxes) and microchiropteran (insectivorous) bat species consisted of harp trapping undertaken at suitable sites for two nights to determine the presence of sub-canopy species, detection of echolocation calls via Anabat II detectors onto audio cassettes and digital memory cards for subsequent computer analysis and spotlighting for flying foxes and large microchiropteran bats.
- Diurnal investigations for reptiles involved searching beneath ground litter, such as sheets or iron, fallen timber, leaf litter, decorticated bark on tree trunks and on the ground, tuft of vegetation and stones. Searches incorporated both opportunistic searches as well as intensive searches within an area for approximately 30 to 60 minutes. Nocturnal spotlight searches for reptiles were undertaken on foot in conjunction with arboreal mammals.
- Surveys were undertaken of water bodies (i.e. dams) and drainage lines of the area to identify frog species, which may include those species not recorded during other surveys. Nocturnal searches involved walking along drainage lines and through swamp habitat involving standard techniques such as spotlighting around water bodies and along creek lines, identification of individuals present by audible call, eliciting of responses to play-back of calls and searches in likely microhabitats.

A summary of the survey effort is provided in Table 1.

Table 1: Fauna survey effort (adapted from Bell and Murray 2004)

| Fauna Group | Survey Sites | Technique | Survey Effort | Total Survey Effort |
|------------------|--------------|--------------------|---|---------------------|
| Small Mammals | 3 sites | Elliott A | 25 traps / night for 3 nights | 225 trap nights |
| Larger Mammals | 3 sites | Cage Trap | 2 traps / site for 3 nights | 18 trap nights |
| Arboreal Mammals | 3 sites | Elliott B arboreal | 10 traps / site for 3 nights | 90 trap nights |
| | | Spotlight Searches | 30 mins per search (Oct, Nov) | 6.0 hours |
| Bats All | 4 sites | Harp Trap | 2 trap nights per site | 8 harp trap nights |
| | 4 sites | Anabat Recording | 2 all night recordings per site x 2 sample periods | 16 nights |
| Reptiles | 3 sites | Diurnal searches | 1 hr searches per site | 3 hours |
| Amphibians | 5 sites | Nocturnal searches | 30min searches of specific habitats (dams, creek lines) | 2.5 hours |

Although targeted survey had previously been completed within the assessment area, the BCAM also requires a minimum number of Biometric vegetation transects/plots be completed to satisfy the methodology. The assessment of WTC BCAA required a minimum of 9 transects/plots (based on the number and area of vegetation zones). Twelve (12) were completed for the assessment area. The location of the transects/plots are provided in Figure 5.

As comprehensive studies have previously been undertaken across the study site, no additional targeted threatened species surveys were conducted as part of this biocertification assessment. Opportunistic observations were made as transects/plots were completed, however, and these opportunistic observations were included in the overall results of this assessment.

A range of threatened species and endangered ecological communities were identified within the WTC BCAA from the previous studies and from ELAs work on site for this assessment. The threatened species and endangered ecological identified are provided in Table 2.

Table 2: Threatened species and ecological communities

| Threatened Species | Status | | Recorded in the Study Area | Credit Type | Population size (Flora) |
|--|---------|----------|----------------------------|-------------|-------------------------|
| | TSC Act | EPBC Act | | | |
| Flora | | | | | |
| <i>Rutidosis heterogama</i> | V | V | Yes | Species | ~1000 plants |
| Fauna | | | | | |
| Powerful Owl | V | - | Yes | Ecosystem | |
| Masked Owl | V | - | Yes | Ecosystem | |
| Squirrel Glider | V | - | Yes | Ecosystem | |
| Wallum Froglet | V | - | Yes | Species | |
| Endangered Ecological Communities | | | | | |
| Swamp Sclerophyll Forest on Coastal Floodplains NSW North Coast, Sydney Basin and South-East Corner bioregions | EEC | - | Yes | Ecosystem | 0.1ha |

2.2 BIOMETRIC VEGETATION TYPE AND CONDITION MAPPING

Within the WTC BCAA defined for this project, Bell and Murray (2004) recorded 5 unique vegetation communities. The vegetation mapping prepared by Bell and Murray (2004) formed the base for the Biocertification Assessment of the WTC.

The vegetation communities identified at the WTC study site were converted to Biometric vegetation types through comparison between the vegetation descriptions provided in Bell and Murray (2004) and the Biometric Vegetation Types Database. The equivalent Biometric vegetation types for each vegetation community in the surrounding areas are outlined in Table 3 and described in detail in section 2.6. Farm dams (previously mapped on site as Freshwater Wetlands) were assessed and fringing vegetation assigned to the nearest pre-1750 vegetation type (as the dam vegetation represents a derived community). Areas of open water (as they are not „vegetated”) were not mapped.

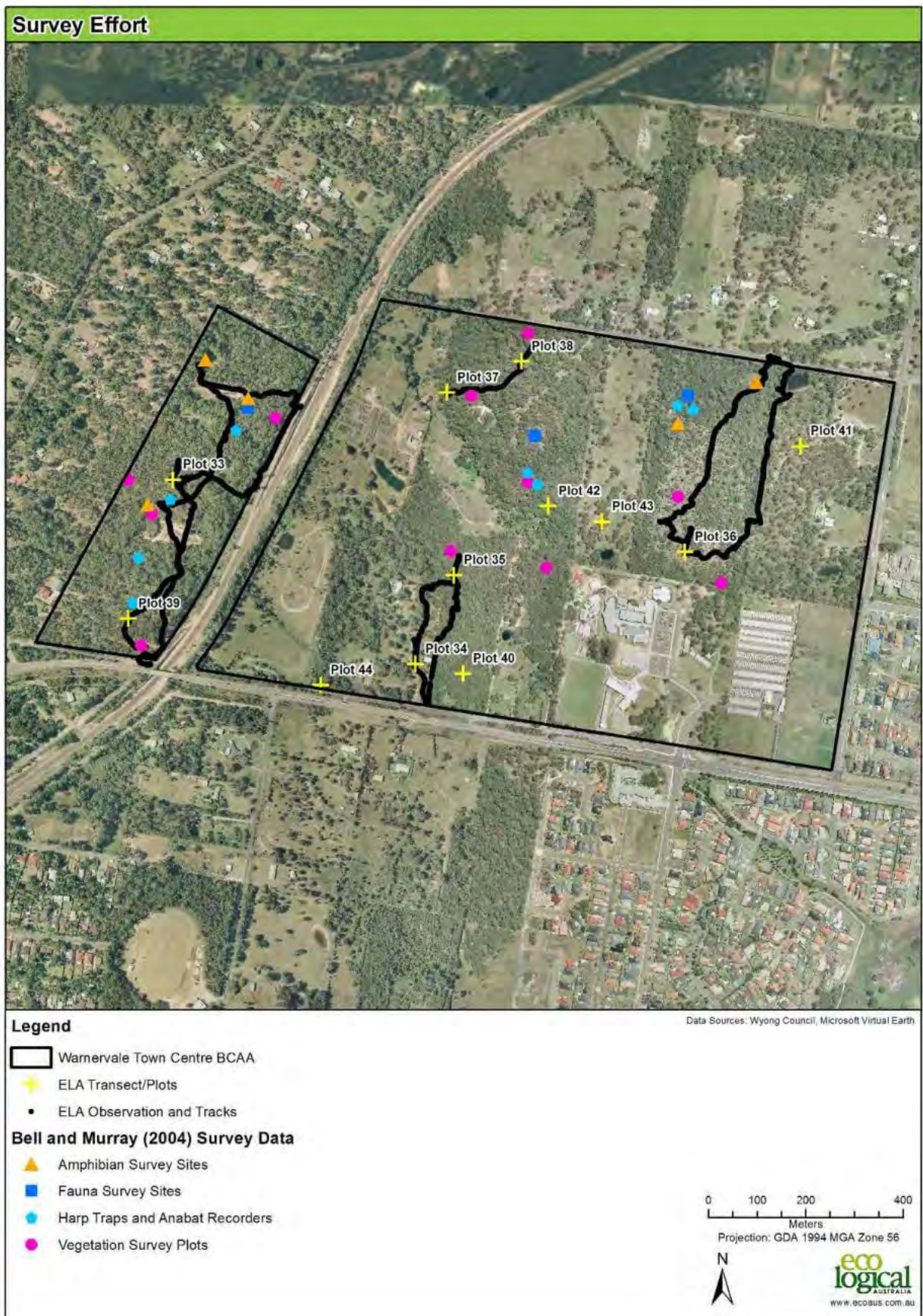


Figure 5: Survey Effort

Table 3: Biometric Vegetation Type Conversions

| Bell and Murray Map Unit | Bell and Murray (2007) Vegetation Community | Biometric Vegetation Type | Comments |
|--------------------------|---|--|--|
| 14 | Freshwater Wetlands | Fringing vegetation assigned nearest vegetation type (i.e. one of the four vegetation types present on site) | Fringing vegetation was assigned nearest vegetation type. Areas of water were not mapped as native vegetation. |
| 20 | Alluvial Floodplain Shrub Swamp Forest | Swamp Mahogany swamp forest on coastal lowlands of the North Coast and northern Sydney Basin | The Biometric Vegetation Type appears to be a good fit for this vegetation community |
| 27 | Narrabeen Coastal Blackbutt Shrubby Forest | Blackbutt - Turpentine open forest of the foothills of the North Coast | The Biometric Vegetation Type appears to be a good fit for this vegetation community |
| 28 | Narrabeen Buttonderry Foothilpes Forest | Smooth-barked Apple - Red Bloodwood open forest on coastal plains on the Central Coast, Sydney Basin | The Biometric Vegetation Type appears to be a good fit for this vegetation community |
| 30 | Narrabeen Dooralong Spotted Gum Ironbark Forest | Spotted Gum - Grey Ironbark open forest on the foothills of the Central Coast, Sydney Basin | This Biometric Vegetation Type appears to be an appropriate fit for this vegetation community. |

Following the conversion of communities to Biometric types, the existing vegetation mapping (Bell and Murray 2004) was tagged with the corresponding Biometric vegetation types as outlined in Table 3. The vegetation mapping within the WTC study sites was subsequently updated using a „heads-up“ on-screen digitising approach to capture vegetation which had not previously been mapped. Additional vegetation added to the mapping layer included areas of moderately dense paddock trees, dense regrowth which may not have been present during the original mapping and some minor areas which have been added to the assessment area due to boundary changes. Areas which had been cleared since the original mapping were also removed (including general tidying-up of the vegetation community boundaries).

All vegetation within the BCAA was assigned to the „moderate to good“ condition category as defined by the BCAM. Due to the varying quality of the „moderate to good“ condition vegetation within the BCAA, however, several ancillary codes were required to stratify the site into vegetation zones. The ancillary codes used were „good“, „moderate“ and „poor“ and were based on previous mapping on site and field inspection.


The condition assessment involved the categorisation of vegetation based on a two-stage process. Vegetation which had been identified to community level by Bell and Murray (2004) was automatically assigned a condition of „good“, while those areas identified as variously disturbed (i.e. coded Xs or Xr) were assigned a condition of „moderate“. All other areas were visually assessed and assigned either a condition of „good“, „moderate“ or „poor“. Generally areas assigned a condition of „good“ had all structural layers present, areas assigned „moderate“ consisted of dense regrowth and areas assigned „poor“ consisted primarily of scattered remnant canopy trees over a highly disturbed but predominantly native groundlayer.


Minor changes and alterations were made to Biometric vegetation type boundaries where two condition states were present within one vegetation polygon; and a number of polygons automatically assigned a condition of „moderate“ were upgraded to „good“ based on visual assessment of the aerial photography and field observations.


Due to the use of previously completed mapping as the basis of the vegetation and condition map for the site, and the conversion of this previous mapping into Biometric vegetation types, some site scale inconsistencies in the vegetation mapping were identified at a small number of the sites visited and traversed. In these cases the vegetation mapping was updated.

2.3 VEGETATION TYPE DESCRIPTIONS

Vegetation descriptions for Blackbutt - Turpentine open forest of the foothills of the North Coast, Smooth-barked Apple - Red Bloodwood open forest on coastal plains on the Central Coast, Sydney Basin, Spotted Gum - Grey Ironbark open forest on the foothills of the Central Coast, Sydney Basin and Swamp Mahogany swamp forest on coastal lowlands of the North Coast and northern Sydney Basin are provided below.

| | |
|----------------------------------|---|
| Biometric Vegetation Type | BLACKBUTT – TURPENTINE OPEN FOREST OF THE FOOTHILLS OF THE NORTH COAST |
| Site | WTC |
| Location | On the upper sandstone slopes and ridgetop in the centre of the WTC study site. |
| Description | <p>This vegetation type was open forest in structure (Specht and Specht 2002) with trees generally 20 to 25m in height with projected foliage cover in the order of 30%.</p> <p>The majority of this vegetation type had been recently burnt (<2yrs) with a number of fire trails dissecting the vegetation. Many of the larger trees had lopped branches along the trackside.</p> |
| |  |
| Canopy | This vegetation type had a canopy dominated by <i>Eucalyptus pilularis</i> with <i>Angophora costata</i> occurring as a co-dominant species. |
| Midstorey | Characterised by <i>Allocasuarina littoralis</i> . |
| Groundcovers | The groundcover of this vegetation type was characterised by a number of native species including <i>Entolasia stricta</i> , <i>Pteridium esculentum</i> , <i>Themeda australis</i> and <i>Xanthorrhoea</i> spp. |
| Threatened Species/EEC | None observed. |
| Weeds | <i>Bidens pilosa</i> , <i>Lantana camara</i> , <i>Ligustrum sinense</i> and <i>Senecio madagascariensis</i> . |

| | |
|----------------------------------|---|
| Biometric Vegetation Type | SMOOTH-BARKED APPLE - RED BLOODWOOD OPEN FOREST ON COASTAL PLAINS ON THE CENTRAL COAST, SYDNEY BASIN |
| Location | Slightly elevated and sloping sections of the WEZ study site and the majority of the WTC study site. |
| Description | This vegetation type varied from woodland to open forest in structure (Specht and Specht 2002) with trees generally from 15 to 25m in height with projected foliage cover in the order of 20-40%. While there has been disturbance and clearing across this vegetation type, large intact areas still remain at both study sites. |
| |  |
| Canopy | This vegetation type has a canopy co-dominated by <i>Angophora costata</i> , <i>Eucalyptus capitellata</i> and <i>Corymbia gummifera</i> , although a range of other species were frequently recorded including <i>C. maculata</i> , <i>E. globoidea</i> and <i>E. umbra</i> |
| Midstorey | The midstorey of this vegetation type generally consists of commonly recorded species such as <i>Melaleuca nodosa</i> , <i>Banksia spinulosa</i> var. <i>collina</i> , <i>Allocasuarina littoralis</i> and <i>Leptospermum trinervium</i> . |
| Groundcovers | The groundcover of this vegetation type was dominated by sedges and grasses, including species such as <i>Imperata cylindrica</i> , <i>Entolasia stricta</i> , <i>Xanthorrhoea media</i> , <i>Gahnia radula</i> , <i>Cyathochaeta diandra</i> and <i>Lepyrodia scariosa</i> . |
| Threatened Species/EEC | Wallum froglet. |
| Weeds | More disturbed areas were dominated by weeds such as <i>Andropogon virginicus</i> but the more intact areas were relatively weed free. |

| | |
|----------------------------------|--|
| Biometric Vegetation Type | SPOTTED GUM - GREY IRONBARK OPEN FOREST ON THE FOOTHILLS OF THE CENTRAL COAST, SYDNEY BASIN |
| Location | More elevated sections in the west of the WEZ and WTC study sites. |
| Description | This vegetation type was generally open forest in structure (Specht and Specht 2002) with trees to 25m in height with projected foliage cover in the order of 20-40%. |
| |  |
| Canopy | This vegetation type was highly variable and consisted of a range of canopy species; however <i>Corymbia maculata</i> was recorded in all patches in association with a range of ironbarks. Co-dominant species included <i>Angophora costata</i> , <i>E. capitellata</i> , <i>E. crebra</i> , <i>E. fibrosa</i> , <i>E. globoidea</i> , <i>E. paniculata</i> and <i>E. siderophloia</i> . |
| Midstorey | The midstorey of this vegetation type varied from open to dense and was marked by the shrub <i>Melaleuca nodosa</i> . Other commonly recorded midstorey species included <i>Exocarpos cupressiformis</i> , <i>Melaleuca linariifolia</i> , <i>Allocasuarina torulosa</i> and <i>Allocasuarina littoralis</i> . Smaller shrubs included <i>Daviesia ulicifolia</i> and <i>Pultenaea villosa</i> . |
| Groundcovers | Commonly recorded groundcover species included <i>Dianella caerulea</i> var. <i>producta</i> , <i>Entolasia stricta</i> , <i>Gahnia clarkei</i> , <i>Gahnia radula</i> , <i>Imperata cylindrica</i> , <i>Lepidosperma laterale</i> and <i>Themeda australis</i> . |
| Threatened Species/EEC | Rutidosia heterogama, Wallum froglet. |
| Weeds | Some areas of this community have been extensively invaded by <i>Lantana camara</i> at the WTC study site. |

| | |
|----------------------------------|--|
| Biometric Vegetation Type | SWAMP MAHOGANY SWAMP FOREST ON COASTAL LOWLANDS OF THE NORTH COAST AND NORTHERN SYDNEY BASIN |
| Location | Very small patch on southern edge of WTC. |
| Description | This vegetation type contained canopy and mid storey within benchmark. Very few <i>Eucalyptus robusta</i> were present on site, which generally characterise this community. |
| |  |
| Canopy | This vegetation type had a canopy containing <i>Angophora costata</i> , <i>Eucalyptus robusta</i> and <i>Corymbia gummifera</i> . |
| Midstorey | Characterised by <i>Melaleuca nodosa</i> and <i>Allocasuarina littoralis</i> . |
| Groundcovers | The groundcover of this vegetation type was characterised by a number of native species including <i>Gahnia clarkei</i> , <i>Gleichenia dicarpa</i> and <i>Entolasia marginata</i> . |
| Threatened Species/EEC | Swamp sclerophyll forest on coastal floodplains of the NSW North Coast, Sydney Basin and South East Corner bioregions EEC |
| Weeds | The small patch did contain some <i>Lantana camara</i> . |

2.4 ENDANGERED ECOLOGICAL COMMUNITY MAPPING

Endangered Ecological Communities (EECs) within the WTC BCAA were mapped based on Bell and Murray (2004) who identified one small area of Swamp Sclerophyll Forest (SSF) adjoining Sparks Road. No attempt was made to validate the EEC mapping of Bell and Murray (2004), however it is considered to be largely accurate.

Since the original Bell and Murray (2004) study, there has been conjecture regarding the presence of Lower Hunter Spotted Gum Ironbark Forest EEC within the WTC study site. A detailed and quantitative analysis of this issue has been prepared (Appendix 1). This analysis has concluded that no Lower Hunter Spotted Gum Ironbark Forest EEC occurs within the WTC study site.

2.5 THREATENED SPECIES OBSERVATIONS

As comprehensive studies have previously been undertaken across the study site, no additional targeted threatened species surveys were included as part of this Biocertification Assessment. Opportunistic observations were made, however, and the results of the previous assessments also considered.

From the previous work completed within the WTC BCAA (Bell and Murray 2004), and the opportunistic observations made, two threatened species (requiring species credits) were identified as present within the WTC BCAA.

The flora species *Rutidosia heterogama* occurs both within the BCAA and outside the BCAA within the railway sidings. Previous surveys from Bell and Murray (2004) and ELA (2005, 2008) were used to determine the species presence and number within the BCAA (Figure 6).

Wallum froglet was also identified in three locations across the site, and the habitat mapped (Figure 6). The observations made by ELA during this study were consistent with those areas also identified by Bell and Murray (2004).

Details on the calculation of credits for each of these species are contained in Section 3.8. The species predicted on site by the Biobanking Credit Calculator v 1.2, and those requiring survey, are provided in Appendix 2.

The results provided in Appendix 2 for species requiring survey identify two species which have not received specific targeted survey within the appropriate specified months, being Wallum Froglet and *Diuris praecox*.

2.5.1 Wallum Froglet

The survey period for the Wallum Froglet specified by the Threatened Species Profile Database (TSPD), and therefore recommended by the BCAM, is December to August. Several surveys were conducted during this time (site reconnaissance and targeted flora survey) and observations of Wallum Froglet noted, however no targeted survey was conducted during these months.

Targeted survey was conducted for amphibians in October and November, with the Wallum Froglet recorded during the surveys conducted. Although the TSPD lists December to August as the appropriate survey time (as described above), the *Threatened species survey and assessment guidelines: field survey methods for fauna- Amphibians* (DECCW 2009) states that November to May is an appropriate survey time for the species, and adds that “males call at any time of the year, especially after heavy rain, and can sometimes be heard during the day after rain.” (DECCW 2009).

The survey effort for Wallum Froglet is therefore considered appropriate for the site as:

- Targeted surveys were conducted at the time of year recommended by the DECCW (2009) guidelines (November)
- The DECCW (2009) guidelines indicate that the time of year may not influence the calling of male Wallum Froglets
- Observations were completed during site reconnaissance and targeted flora survey within the period specified by the TSPD

2.5.2 *Diuris praecox*

The survey period for *Diuris praecox* identified within the TSPD is July and August. Targeted flora survey was completed by Bell and Murray between September 2003 and January 2004 (Bell and Murray 2004), with *Diuris praecox* specifically considered during the project. Bell and Murray also completed site reconnaissance in August 2003, and although not a targeted survey the site was traversed in some detail and observations noted.

The species is best identified during flowering, and although the TSPD does recommend targeted survey between July and August, several sources indicate that the species can be identified during September (particularly early September), including NSW Flora Online and the Wyong Council Flora and Fauna Guidelines for Development (Wyong Council 1999).

The survey effort for *Diuris praecox* is therefore considered appropriate for the site as:

- Targeted survey (particularly for orchids) was conducted by Bell and Murray in September 2003, which is within the period specified by several sources
- Observations were completed during site reconnaissance within the period specified by the TSPD (August)

Finally, the nearest Atlas of NSW Wildlife record for *Diuris praecox* is 11km north-east of the WTC BCAA. Considering this, the survey effort on site and the expertise of the surveyor (Stephen Bell), it is considered that the species would have been detected if present.

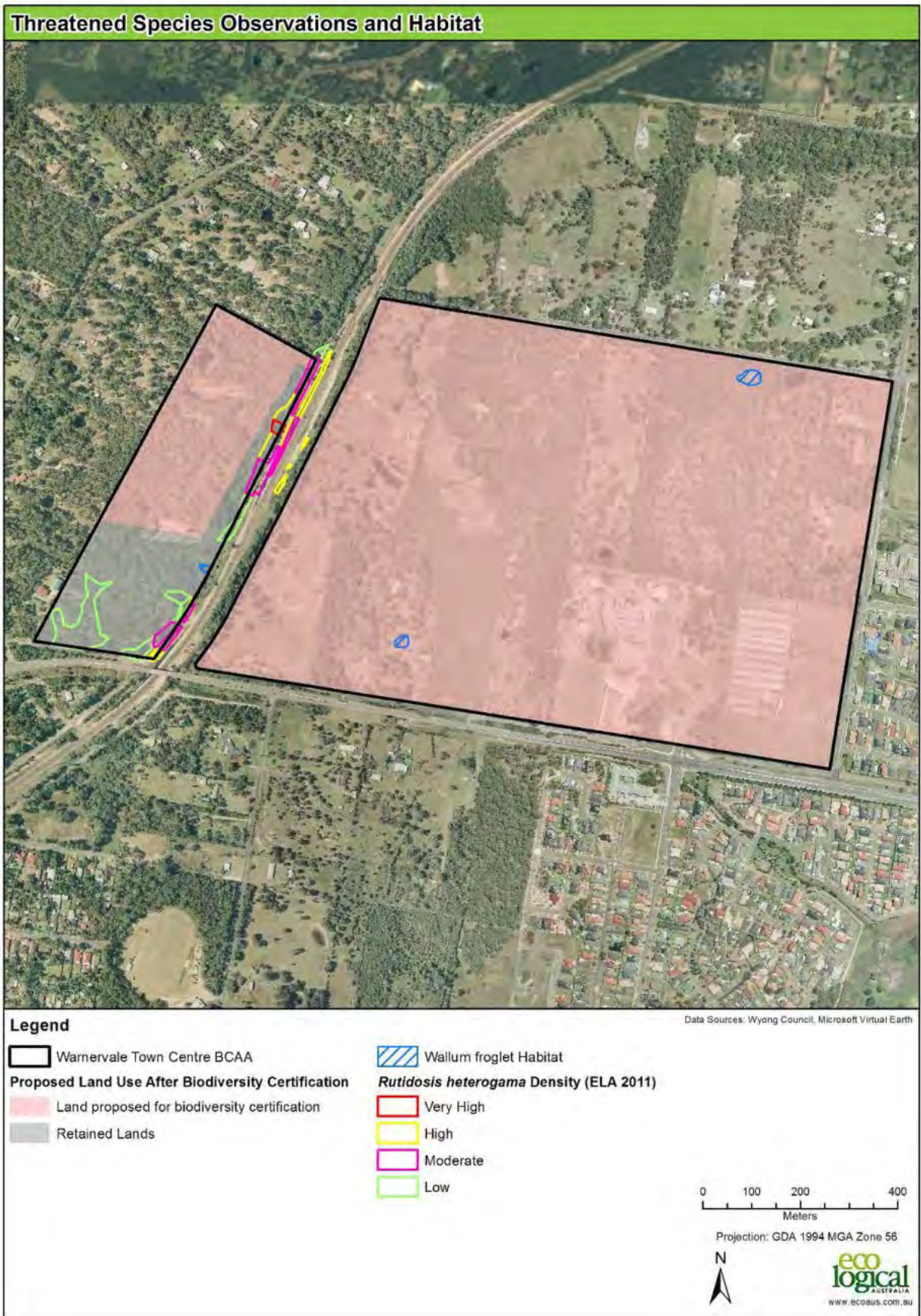


Figure 6: Threatened Species Observations and Habitat

3 Biocertification Assessment Results

3.1 BIODIVERSITY CERTIFICATION ASSESSMENT AREA

The WTC BCAA contains two proposed land uses to be assessed:

- Land proposed for biodiversity certification (i.e. development)
- Retained lands

The footprint proposed for biodiversity certification is 104.9ha (68.4ha of which is vegetated) (Table 4). Zero (0) hectares of land are proposed for conservation measures, with 8.5ha of land identified as retained lands (i.e. the Daisy Reserve or footbridge).

As described in section 1.2 some of the land proposed for biodiversity certification is, in fact, public recreation and riparian corridor (environmentally zoned land) which will receive some impact through infrastructure and recreation pathways (although some native vegetation and biodiversity value will be retained within those lands).

The public recreation and riparian corridor (environmentally zoned land) will be acquired by Council using funds obtained from Section 94. These areas will be owned and maintained by Council. The timing of acquisition of these areas will be influenced by the take up of development on the Warnervale Town Centre.

Table 4: Land use breakdown

| Development Footprint | Area (ha) |
|--|--------------|
| Land Proposed for Biodiversity Certification (Development) | 104.9 |
| Land Proposed for Conservation | 0.0 |
| Retained Lands (Land excluded from this assessment) | 8.5 |
| Total | 113.4 |

3.2 VEGETATION MAPPING AND ZONES

Across the entire site four vegetation types were identified (Table 5 and Figure 7). In total 76.6ha of vegetation was mapped across the site, with the dominant vegetation types being Smooth-barked Apple - Red Bloodwood open forest on coastal plains on the Central Coast, Sydney Basin (45.7ha) and Spotted Gum - Grey Ironbark open forest on the foothills of the Central Coast, Sydney Basin (24.2ha). Cleared land makes up 36.8ha of the site.

Table 5: Area of vegetation within the BCAA

| Biometric Vegetation Type | Area (ha) |
|--|--------------|
| Blackbutt - Turpentine open forest of the foothills of the North Coast | 6.6 |
| Smooth-barked Apple - Red Bloodwood open forest on coastal plains on the Central Coast, Sydney Basin | 45.7 |
| Spotted Gum - Grey Ironbark open forest on the foothills of the Central Coast, Sydney Basin | 24.2 |
| Swamp Mahogany swamp forest on coastal lowlands of the North Coast and northern Sydney Basin | 0.1 |
| Cleared land | 36.8 |
| Total | 113.4 |

The four vegetation types have been separated into 7 vegetation zones for this assessment (Figure 8). All vegetation mapped is in moderate to good condition, however ancillary codes have been used to further separate vegetation zones, and include the following:

- Poor- generally areas of scattered remnant canopy trees over a highly disturbed, but predominantly native ground layer
- Moderate- generally areas of regrowth
- Good- best examples of native, intact vegetation on site (all structural layers present)

The proposed footprint consists of 0ha of vegetation to be conserved, 68.4ha of vegetation within the development footprint, with a further 8.2ha of vegetation excluded from the assessment due to its status as retained land (Table 6).

Table 6: Area of vegetation zones within the BCAA (excluding cleared land)

| Veg Zone ID | Biometric Vegetation Type | Condition | Ancillary Condition Code | Condition Description | Area (ha) | | |
|-------------|--|------------------|--------------------------|--|--------------------------------|--|---------------|
| | | | | | Land Proposed for Conservation | Land Proposed for Biodiversity Certification | Retained Land |
| 1 | Blackbutt - Turpentine open forest of the foothills of the North Coast | Moderate to Good | Good | Majority of this vegetation type had been recently burnt (<2yrs). All structural layers present, with some weed species. | 0 | 6.6 | 0 |
| 2 | Smooth-barked Apple - Red Bloodwood open forest on coastal plains on the Central Coast, Sydney Basin | Moderate to Good | Poor | Scattered trees over predominantly non-native understorey. Some highly disturbed areas to be included in conservation lands and rehabilitated. | 0 | 12.5 | 0 |
| 3 | Smooth-barked Apple - Red Bloodwood open forest on coastal plains on the Central Coast, Sydney Basin | Moderate to Good | Moderate | Areas code Xs or Xr in Bell and Murray 2004. Also includes some areas of dense regrowth. Some areas of weed infestation, particularly <i>Andropogon virginicus</i> . | 0 | 24.4 | 0 |
| 4 | Smooth-barked Apple - Red Bloodwood open forest on coastal plains on the Central Coast, Sydney Basin | Moderate to Good | Good | Generally weed free, all structural layers present. | 0 | 8.8 | 0 |

| Veg Zone ID | Biometric Vegetation Type | Condition | Ancillary Condition Code | Condition Description | Area (ha) | | |
|--------------|--|------------------|--------------------------|--|--------------------------------|--|---------------|
| | | | | | Land Proposed for Conservation | Land Proposed for Biodiversity Certification | Retained Land |
| 5 | Spotted Gum - Grey Ironbark open forest on the foothills of the Central Coast, Sydney Basin | Moderate to Good | Moderate | Areas code Xs or Xr in Bell and Murray 2004. Also includes some areas of dense regrowth. Some highly disturbed areas to be included in conservation lands and rehabilitated. Highly disturbed in some areas by <i>Lantana camara</i> . | 0 | 8.5 | 0.7 |
| 6 | Spotted Gum - Grey Ironbark open forest on the foothills of the Central Coast, Sydney Basin | Moderate to Good | Good | Generally weed free, all structural layers present. | 0 | 7.5 | 7.5 |
| 7 | Swamp Mahogany swamp forest on coastal lowlands of the North Coast and northern Sydney Basin | Moderate to Good | Good | Small patch of EEC, very little <i>Eucalyptus robusta</i> present and some <i>Lantana camara</i> present. | 0 | 0.1 | 0 |
| Cleared Land | | | | | 0 | 36.5 | 0.3 |
| Total | N/A | N/A | N/A | N/A | 0 | 104.9 | 8.5 |

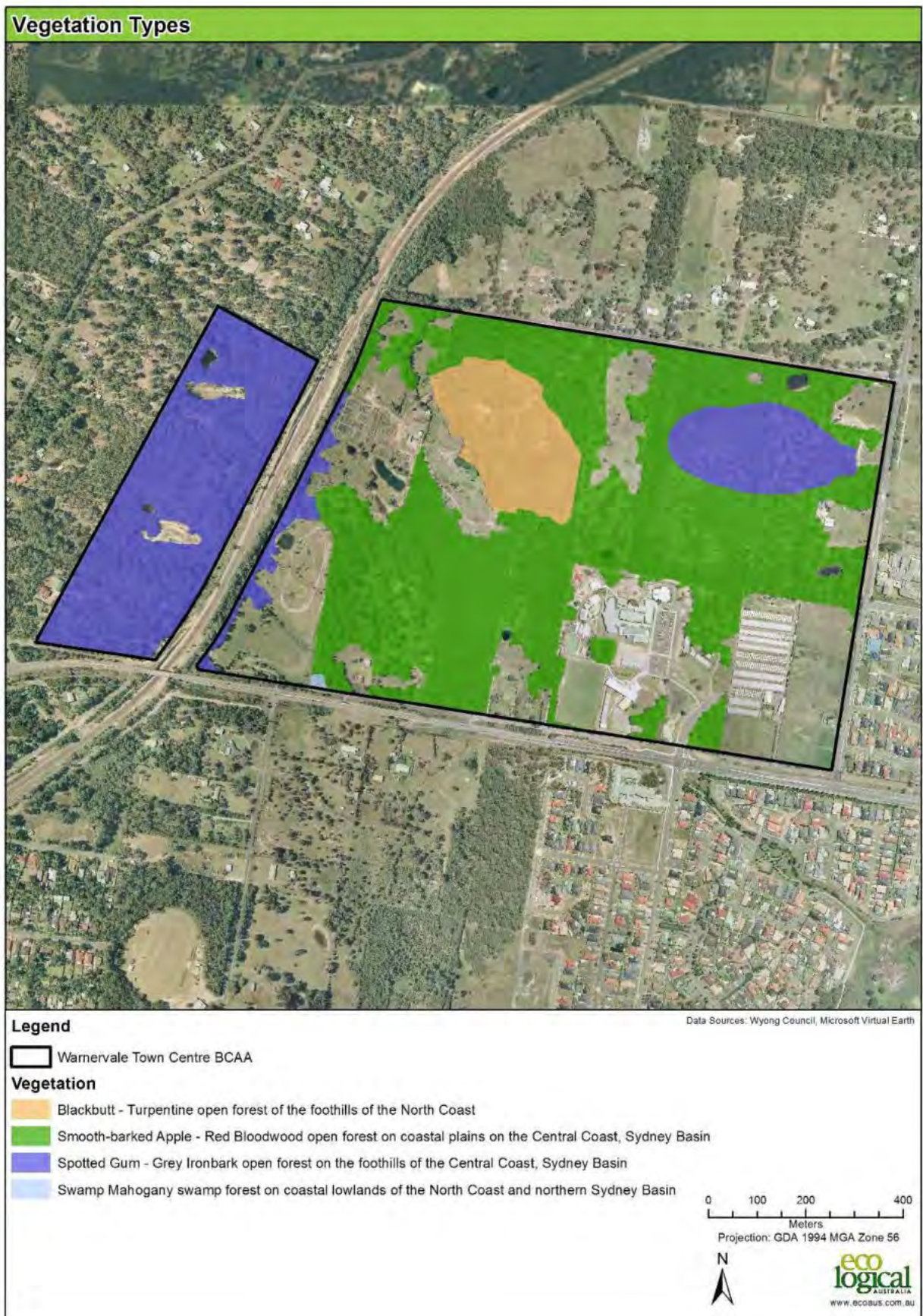


Figure 7: Vegetation Types

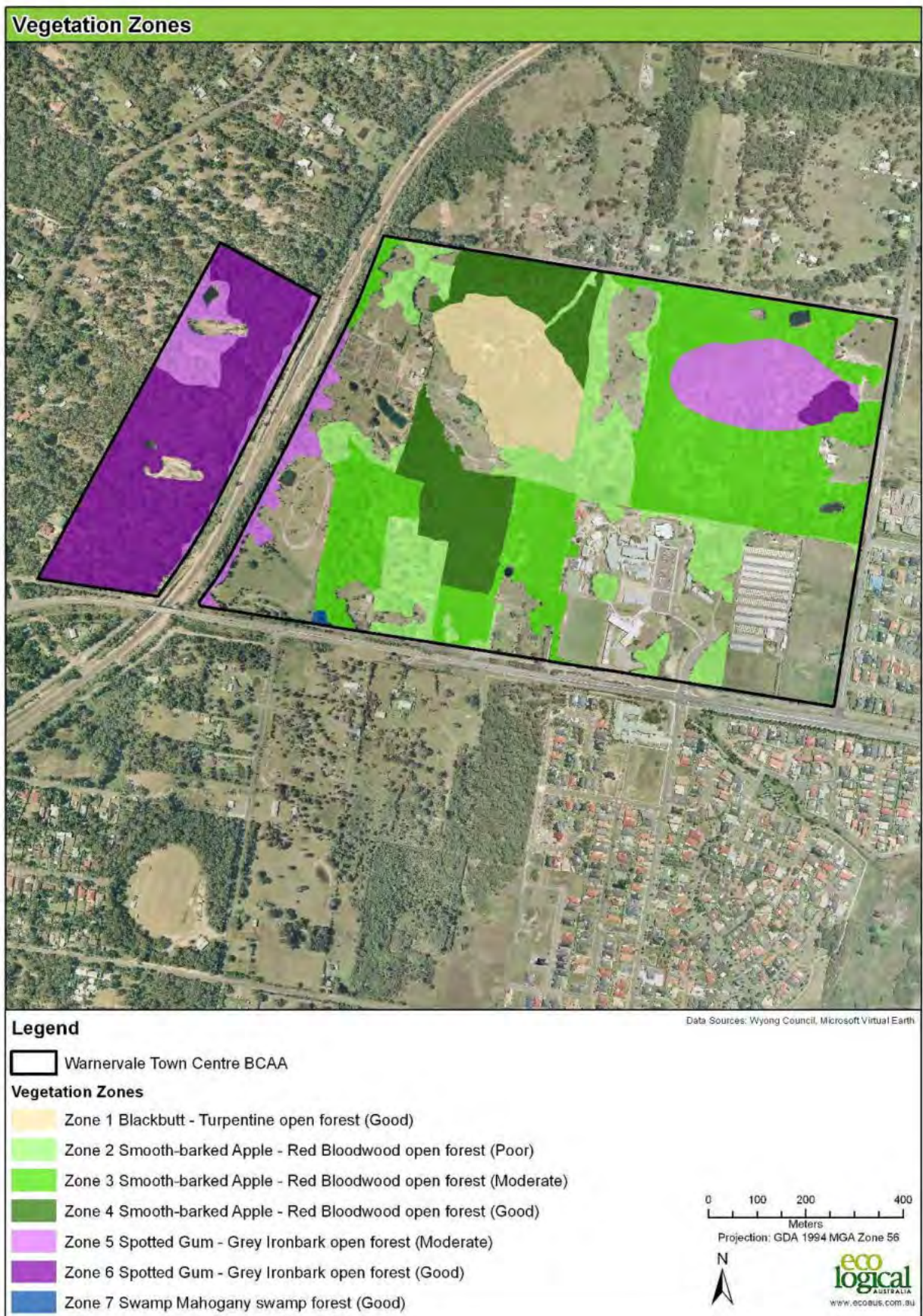


Figure 8: Vegetation Zones

3.3 LANDSCAPE Tg VALUES

Landscape Tg values are required to calculate ecosystem credits using the Biocertification Methodology. The Landscape Tg values are generated for each vegetation type by averaging the Tg values of all species predicted to occur in each vegetation type within the study site (Table 7).

ELA calculated the Landscape Tg value for each vegetation type within the BCAA using the Biobanking Credit Calculator to determine which species were predicted in each vegetation type (Appendix 3). The Tg values for these species were then averaged to calculate the Landscape Tg. The table below provides details of the landscape Tg score used for each vegetation type assessed.

Table 7: Landscape Tg assigned to each vegetation type

| Vegetation Type | Landscape Tg |
|--|--------------|
| Blackbutt - Turpentine open forest of the foothills of the North Coast | 0.54 |
| Smooth-barked Apple - Red Bloodwood open forest on coastal plains on the Central Coast, Sydney Basin | 0.55 |
| Spotted Gum - Grey Ironbark open forest on the foothills of the Central Coast, Sydney Basin | 0.56 |
| Swamp Mahogany swamp forest on coastal lowlands of the North Coast and northern Sydney Basin | 0.55 |

3.4 TRANSECT/PLOT DATA AND SITE VALUE SCORES

Appendix 4 of the BCAM defines the minimum number of transects/plots required per vegetation zone area (DECCW 2011). A total of 12 Biometric vegetation transects/plots were captured across the WTC study site, with a transect/plot requirement of 9 transects/plots calculated from the combined area of conservation and development lands (Figure 9 and Table 8). The transect/plot data captured is provided in Appendix 5.

Table 8: Vegetation zones and transect/plot data

| Veg Zone ID | Biometric Vegetation Type | Condition | Area to be Assessed (land proposed for biodiversity certification) (ha) | Transects/Plots Required | Transects/Plots Collected |
|-------------|--|-----------|---|--------------------------|---------------------------|
| 1 | Blackbutt - Turpentine open forest of the foothills of the North Coast | Good | 6.6 | 1 | 2 |
| 2 | Smooth-barked Apple - Red Bloodwood open forest on coastal plains on the Central Coast, Sydney Basin | Poor | 12.5 | 2 | 2 |
| 3 | Smooth-barked Apple - Red Bloodwood open forest on coastal plains on the Central Coast, Sydney Basin | Moderate | 24.4 | 2 | 2 |
| 4 | Smooth-barked Apple - Red Bloodwood open forest on coastal plains on the Central Coast, Sydney Basin | Good | 8.8 | 1 | 2 |
| 5 | Spotted Gum - Grey Ironbark open forest on the foothills of the Central Coast, Sydney Basin | Moderate | 8.5 | 1 | 1 |
| 6 | Spotted Gum - Grey Ironbark open forest on the foothills of the Central Coast, Sydney Basin | Good | 7.5 | 1 | 2 |
| 7 | Swamp Mahogany swamp forest on coastal lowlands of the North Coast and northern Sydney Basin | Good | 0.1 | 1 | 1 |

| Veg Zone ID | Biometric Vegetation Type | Condition | Area to be Assessed (land proposed for biodiversity certification) (ha) | Transects/ Plots Required | Transects/ Plots Collected |
|--------------|---------------------------|------------|---|---------------------------|----------------------------|
| Total | N/A | N/A | 68.4 | 9 | 12 |

Current site value and future site value scores were calculated for each vegetation zone using the transect/plot data collected. The Biobanking Credit Calculator was used to produce the current and future site value scores for both development and conservation (Table 9).

Table 9: Site value scores allocated to each vegetation zone

| Veg Zone ID | Biometric Vegetation Type | Condition | Current Site Value Score | Future Site Value Score (Development) |
|-------------|--|-----------|--------------------------|---------------------------------------|
| 1 | Blackbutt - Turpentine open forest of the foothills of the North Coast | Good | 87 | 0 |
| 2 | Smooth-barked Apple - Red Bloodwood open forest on coastal plains on the Central Coast, Sydney Basin | Poor | 31 | 0 |
| 3 | Smooth-barked Apple - Red Bloodwood open forest on coastal plains on the Central Coast, Sydney Basin | Moderate | 65 | 0 |
| 4 | Smooth-barked Apple - Red Bloodwood open forest on coastal plains on the Central Coast, Sydney Basin | Good | 63 | 0 |
| 5 | Spotted Gum - Grey Ironbark open forest on the foothills of the Central Coast, Sydney Basin | Moderate | 56 | 0 |
| 6 | Spotted Gum - Grey Ironbark open forest on the foothills of the Central Coast, Sydney Basin | Good | 75 | 0 |
| 7 | Swamp Mahogany swamp forest on coastal lowlands of the North Coast and northern Sydney Basin | Good | 87 | 0 |

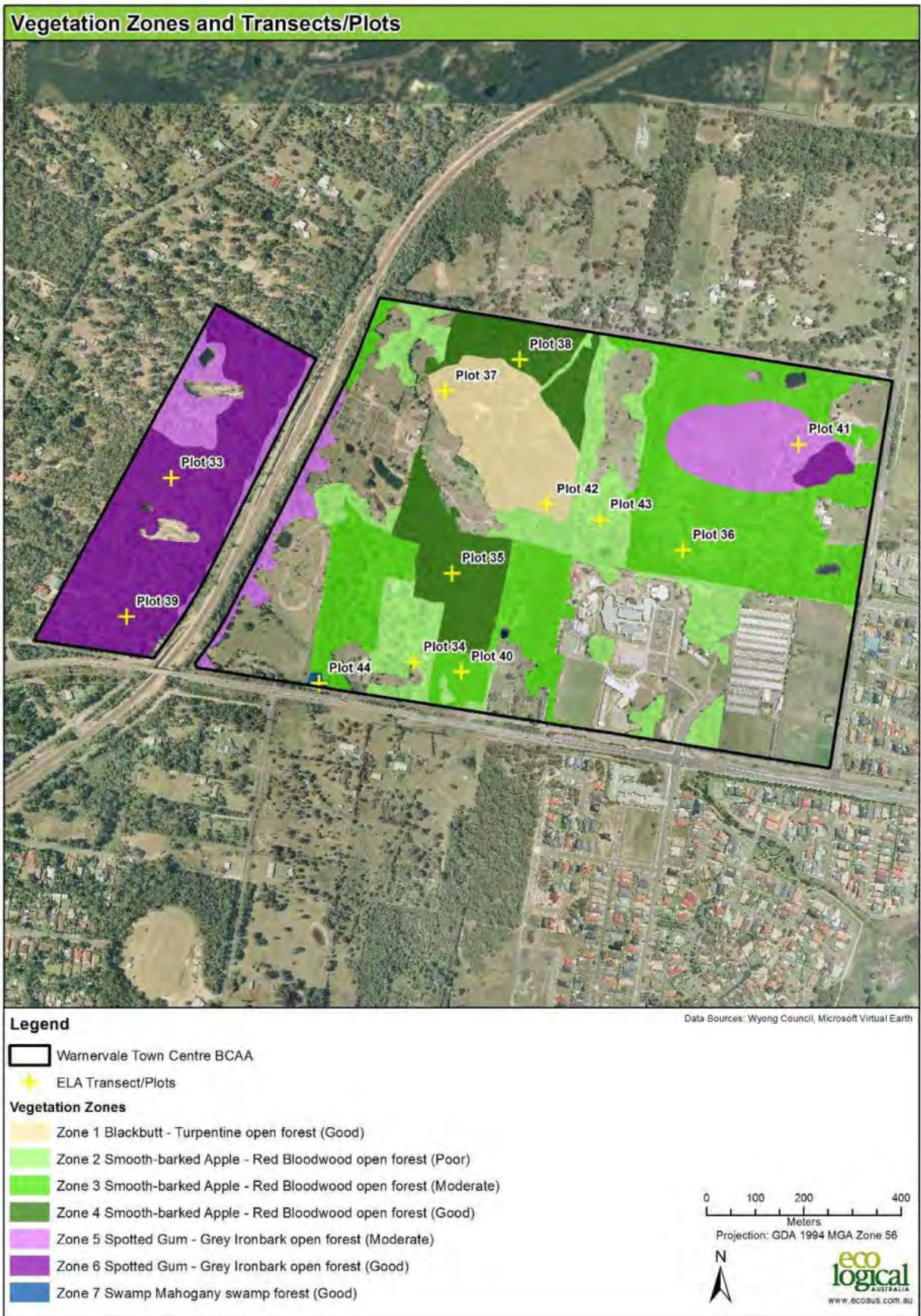


Figure 9: Vegetation Zones and Transects/Plots

3.5 LANDSCAPE SCORE

3.5.1 Native Cover in Landscape

Native vegetation cover within an assessment circle was calculated for the project (Figure 10). The landscape score calculations were completed with a 1,000ha circle, thus a scaling factor of 1.0 was used in the assessment. The results of the circle assessment are contained in Table 10. A pre certification score of 15.0 was allocated, with a post certification score of 13 assigned.

Table 10: Native vegetation in assessment circle

| Circle | BEFORE CERTIFICATION | | AFTER CERTIFICATION | |
|-------------|--|-----------------------------------|--|-----------------------------------|
| | Area of Vegetation Within Assessment Circle (ha) | Native Vegetation Cover Class (%) | Area of Vegetation Within Assessment Circle (ha) | Native Vegetation Cover Class (%) |
| 1 (1,000ha) | 421 (15) | 41-50% | 353 (13) | 31-40% |

The land subject to conservation measures (post biodiversity certification) is 0ha. Therefore (using Table 3 of the BCAM) a gain of 0 is recorded for the percent native vegetation score after conferral of biodiversity certification.

3.5.2 Connectivity Value

The current connectivity value of the site was assessed according to Section 3.7.2 of the BCAM. Initially, the drainage lines on site were considered to determine if any of the riparian lines on site are a State, Regional or Local biodiversity link. The connectivity of vegetation on site was then also assessed.

The streams on site meet the definition of minor watercourses, and require a 10m buffer either side (Figure 11). Minor watercourses are considered local biodiversity links according to Table 4 of the BCAM. Currently segments of these streams are located within development lands, and are therefore likely to be impacted by development. While development on site will require consideration of the *Water Management Act 2000*, this assessment has determined that an impact on a local biodiversity link is likely, and has therefore scored Connectivity (pre certification) 6 points.

Vegetation connectivity was also assessed. Again, local biodiversity links occur across the site, where vegetation is greater than 30ha, and has widths greater than 30m. Some of these areas are to be impacted by development, and will again result in a Connectivity (pre certification) score of 6 points. As the assessment requires the larger of these scores be taken, a Connectivity score (pre certification) score of 6 points is allocated for this assessment.

A post certification score for Connectivity of 0 is applied to this assessment due to the complete impact on local biodiversity links across the site. As there is difference between the pre certification and post certification Connectivity score (of 6 points) additional credits will be required to achieve biodiversity certification for the WTC.

Connectivity (score for conservation measures) was also assessed. The proposal conserves no vegetation within conservation areas, and therefore a post certification score of 0 points is recorded for connectivity.

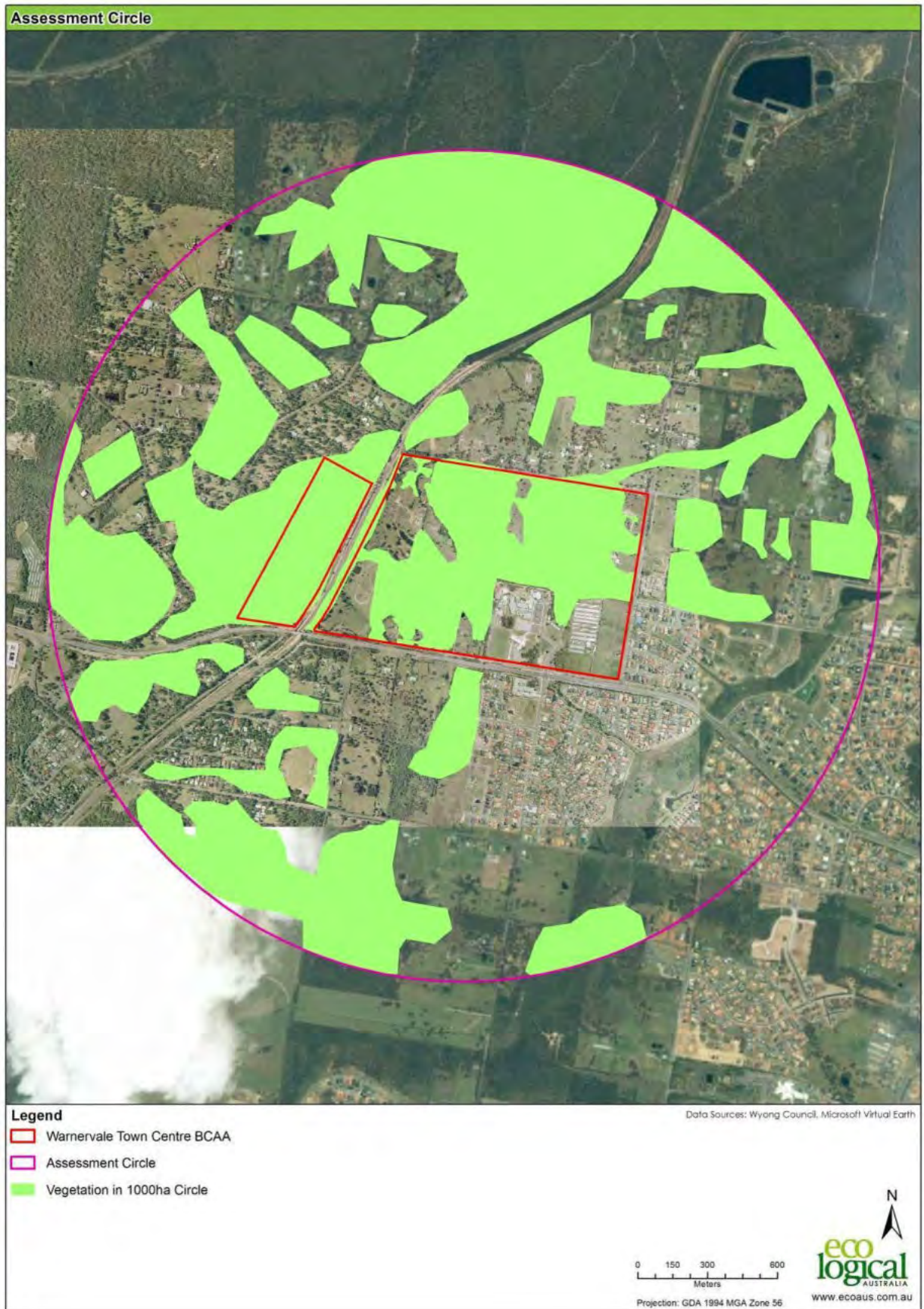


Figure 10: Assessment Circle



Figure 11: Drainage Lines and Buffers

3.5.3 Adjacent Remnant Area

The maximum adjacent remnant area (ARA) was calculated for the proposal in order to determine the score to be allocated for this measure. The site predominantly occurs on the Gosford - Cooranbong Coastal Slopes Mitchell Landscape, which is 38% cleared. The vegetation on site is well connected, and as such has an ARA of 501ha. The pre certification score allocated, therefore, is 10 points.

There are no conservation lands considered in this assessment post certification. As such the post certification score allocated is 0 points.

3.6 THREATENED SPECIES ASSESSMENT

3.6.1 Wallum Froglet

Wallum froglet habitat has been identified within the BCAA in three locations (Figure 6). One polygon (0.02ha) is located within the retained lands, and therefore does not require the calculation of credits. 0.16ha of habitat is located within areas proposed for certification, and therefore requires the calculation of credits.

3.6.2 *Rutidosis heterogama*

Rutidosis heterogama occurs both within and outside the BCAA, with the majority of the population occurring within the retained lands (Daisy Reserve). Some impact, however, does occur from the proposed road at the northern end of the retained lands (Figure 6). Previous population counts were conducted for the species impact statement (SIS) addendum for the North Warnervale Station, and have been made available for this study (ELA 2011). These counts were conducted in 2005.

A *Rutidosis heterogama* population of 4,980 was identified across the BCAA and wider railway corridor (ELA 2011). The majority of these individuals are contained within the Daisy Reserve (estimated at 3,846), however do not generate credits due to their status as retained land in this assessment. Other individuals within the population will be impacted by the proposed railway station.

The impacts caused by the proposed biodiversity certification are limited to the road to the north of the Daisy Reserve. The number of individuals to be impacted from the proposed road was calculated as part of the SIS Addendum (ELA 2011), and the impact has been estimated at 114 individuals. Impacts on 114 individuals will therefore be used to calculate the credits for this species.

3.7 RED FLAGS

The 0.1ha polygon of Swamp Mahogany swamp forest on coastal lowlands of the North Coast and northern Sydney Basin has been identified as the listed Endangered Ecological Community (EEC) Swamp sclerophyll forest on coastal floodplains of the NSW North Coast, Sydney Basin and South East Corner bioregions (Figure 12). Impacts to this vegetation type are therefore red-flagged.

As this vegetation zone is located within an area zoned Public Recreation the final impact to this area is not yet confirmed (and may not occur) however for the purposes of this biodiversity certification assessment impacts to this vegetation zone require the approval of a red flag variation. This variation is contained within Appendix 6.

It is the opinion of the assessor that *Rutidosis heterogama* can withstand a temporary reduction in numbers within the BCAA. The use of „certified local data“ is permitted under Section 3.4 of the BCAM, and is considered under Appendix 7 of this report.

Finally, the threatened fauna species impacted by the proposal (Wallum froglet) is not red flagged under the BCAM.



Figure 12: Red flag

3.8 INDIRECT IMPACTS

The BCAM requires that any application for biodiversity certification must demonstrate how the “proposed ownership, management, zoning and development controls of the land proposed for biodiversity certification is intended to mitigate any indirect impacts on biodiversity values” (DECCW 2011). The relevant details regarding the mitigation and management of indirect impacts across the WTC are provided below.

Firstly, the design of the land proposed for biodiversity certification has been precautionary, with several areas contained within the land proposed for biodiversity certification unlikely to be cleared or developed. In addition, all impacts associated with the development, such as roads, Asset Protection Zones (APZs) and other infrastructure will be placed within lands proposed for certification, ensuring indirect impacts associated with this infrastructure are contained within the development footprint and mitigated during the construction phase.

The draft Development Control Plan (DCP) for the WTC (DoP 2011) provides comprehensive management and mitigation measures to significantly reduce any indirect impacts on biodiversity values from the conferral of biodiversity certification. The measures include integrated water cycle management and water sensitive urban design, presence of riparian corridors, tree and biodiversity retention measures and soil controls, among others.

With the implementation of these measures indirect impacts will be mitigated and managed for all land proposed for biodiversity certification. The objectives related to minimising indirect impacts within the DCP are provided below (DoP 2011):

- ***Integrated water cycle management and water sensitive urban design***
 - *To protect the key hydrologic characteristics of Porter’s Creek Wetland and Wallarah Creek*
 - *To guide development consistent with the principles of Water Sensitive Urban Design (WSUD)*
 - *To ensure that stormwater runoff achieves best practice standards*
 - *To limit changes in flow rate and flow duration within the receiving waterways as a result of development*
 - *To protect the receiving wetlands and waterway ecosystems*
 - *To minimise impacts of flood flows discharging from the WTC on downstream waterways*
 - *To mitigate the impacts of urban development on stormwater quality through incorporating best practice stormwater management principles and strategies in development*
 - *To safeguard the environment by improving the quality of water run-off.*
- ***Riparian corridors***
 - *To protect the ecological function of vegetated riparian corridors*

- *To retain, and where appropriate, modify and/or rehabilitate existing watercourses and riparian zones*
- *To reduce the risk of stream erosion within Wallarah Creek and Porter's Creek following development*
- *To create a stable environment that enhances stream ecology*
- *To provide habitat connectivity across the WTC*
- **Tree retention and biodiversity**
 - *To ensure the protection and enhancement of existing significant trees (such as hollows and habitat trees), where possible*
 - *To improve or maintain biodiversity values*
 - *To maintain or improve as much existing vegetation as practicable, through the planting of endemic tree species where appropriate and maintaining native vegetation canopy trees within neighbourhood parks, riparian corridors and street verges to create „stepping- stone corridors“*
 - *To reduce impacts of runoff from roads and impervious areas on adjacent lands*
 - *To manage weeds during and after construction, to prevent the spread of weeds*
- **Soils**
 - *To implement measures as part of development to prevent any degradation of the existing soil and groundwater environment*
 - *To minimise erosion and sediment loss during and after construction*
 - *To minimise water pollution from erosion siltation and sedimentation*
 - *To ensure that development does not contribute to environmental damage of water-courses and vegetation on the WTC and beyond*
 - *To minimise air and water pollution due to soil loss either through erosion or poor site practices*

3.9 CREDIT CALCULATIONS

3.9.1 Ecosystem Credits

Ecosystem credits have been calculated for the impact caused by the proposed biodiversity certification (Appendix 8).

In total, 2,191 credits are required for the land proposed to be developed (Table 11). The largest number of credits is required by the Smooth-barked Apple - Red Bloodwood open forest on coastal plains on the Central Coast, Sydney Basin community (1,355 credits). This is followed by Spotted Gum - Grey Ironbark open forest on the foothills of the Central Coast, Sydney Basin (536 credits), Blackbutt - Turpentine open forest of the foothills of the North Coast (296 credits) and Swamp Mahogany swamp forest on coastal lowlands of the North Coast and northern Sydney Basin (4 credits).

As conservation areas were not identified during this assessment (due to unknown impacts within these areas and the fact that the methodology assumes total loss) no credits are generated by the proposed biodiversity certification. Therefore all 2,191 credits need to be identified and secured off-site.

Table 11: Final ecosystem credit results

| Vegetation type name | Credits Required | Total credits created as managed offset | Credit Status |
|--|------------------|---|---------------|
| Blackbutt - Turpentine open forest of the foothills of the North Coast | 296 | 0 | -296 |
| Smooth-barked Apple - Red Bloodwood open forest on coastal plains on the Central Coast, Sydney Basin | 1,355 | 0 | -1,355 |
| Spotted Gum - Grey Ironbark open forest on the foothills of the Central Coast, Sydney Basin | 536 | 0 | -536 |
| Swamp Mahogany swamp forest on coastal lowlands of the North Coast and northern Sydney Basin | 4 | 0 | -4 |
| Total | 2,191 | 0 | -2,191 |

3.9.2 Species Credits

Species credits have been calculated for the impact caused to both Wallum froglet habitat and *Rutidosia heterogama* individuals by the proposed development (Appendix 8).

In total, 2 Wallum froglet credits are required for the land proposed to be developed (Table 12). No credits are generated as lands have not been identified for conservation. Therefore the species requires 2 credits.

The impact on 114 *Rutidosia heterogama* individuals requires 1,754 credits. Again, no credits are generated as lands have not been identified for conservation. The credit requirement for the species is therefore 1,754 credits Table 12.

Table 12: Final species credit results

| Species name | Credits Required | Total credits created as funded/managed offset | Credit Status |
|-----------------------------|------------------|--|---------------|
| Wallum froglet | 2 | 0 | -2 |
| <i>Rutidosia heterogama</i> | 1,754 | 0 | -1,754 |

3.10 CREDIT PROFILES

A credit profile is the set of attributes that are used to characterise ecosystem or species credits. They form part of the rules for using ecosystem and species credits to offset the impacts on land proposed to be Biocertified. The rules ensure that the vegetation impacted by the land proposed for Biocertification is offset within the same vegetation formation and habitat suitability for threatened species.

Table 13 provides the credit profile details for each of the vegetation types impacted by the WTC proposal. Generally the geographic region able to provide an offset is quite large, with three of the 4 vegetation types able to be offset within five CMA subregions. The exception to this is Swamp

Mahogany swamp forest on coastal lowlands of the North Coast and northern Sydney Basin which can only be offset within the Wyong CMA subregion.

The vegetation types able to provide the offset are more restricted. A total of nine vegetation types can provide the offset, however no vegetation types are able to provide an offset for all vegetation types impacted. Therefore, the offset site(s) will be required to contain several vegetation types to achieve the offset requirements of the methodology, or several offset sites will be required.

Finally, the methodology allows for the variation to the offset requirements should the requirements in Table 13 prove difficult to meet. The variation can only be prepared once all options to offset under the credit profiles below are exhausted.

Credit profiles for species credits are not required as there are no geographic restrictions on obtaining species credits. Should the credit type (i.e. species) be difficult to obtain a variation to the credit rules can be prepared. Again, all options must be exhausted before a variation can be prepared.

Table 13: Ecosystem credit profiles

| Vegetation type name | % Cleared in HCR CMA | Vegetation Formation | CMA Subregions Able to Receive Offset | Vegetation Types Able to Receive Offset |
|--|----------------------|---|--|---|
| Blackbutt - Turpentine open forest of the foothills of the North Coast | 30% | Wet sclerophyll forests (grassy sub-formation) | Hunter Central Rivers CMA Wyong Macleay Hastings Yengo Hunter Hawkesbury Nepean CMA Pittwater Yengo | Blackbutt - Tallowwood dry grassy open forest of the southern North Coast Blackbutt - Turpentine open forest of the foothills of the North Coast Small-fruited Grey Gum - Tallowwood shrubby open forest on coastal foothills of the southern North Coast Tallowwood - Small-fruited Grey Gum dry grassy open forest of the foothills of the North Coast |
| Smooth-barked Apple - Red Bloodwood open forest on coastal plains on the Central Coast, Sydney Basin | 35% | Dry sclerophyll forests (shrubby sub-formation) | Hunter Central Rivers CMA Wyong Yengo Hunter Hawkesbury Nepean CMA Pittwater Yengo | Scribbly Gum - Red Bloodwood heathy woodland on the coastal plains of the Central Coast, Sydney Basin Smooth-barked Apple - Red Bloodwood open forest on coastal plains on the Central Coast, Sydney Basin |
| Spotted Gum - Grey Ironbark open forest on the foothills of the Central Coast, Sydney Basin | 45% | Dry sclerophyll forests (shrub/grass sub-formation) | Hunter Central Rivers CMA Wyong Yengo Hunter Hawkesbury Nepean CMA Pittwater Yengo | Broad-leaved Stringybark - Blakely's Red Gum grassy woodlands of the gorges and upper Hunter Valley, North Coast Spotted Gum - Grey Ironbark open forest on the foothills of the Central Coast, Sydney Basin |

| Vegetation type name | % Cleared in HCR CMA | Vegetation Formation | CMA Subregions Able to Receive Offset | Vegetation Types Able to Receive Offset |
|--|----------------------|----------------------|---------------------------------------|--|
| Swamp Mahogany swamp forest on coastal lowlands of the North Coast and northern Sydney Basin | 60 | Forested Wetlands | Wyong | Swamp Mahogany swamp forest on coastal lowlands of the North Coast and northern Sydney Basin |

4 Credit Converter

4.1 ESTIMATED CREDIT COST

The OEH Credit Converter was used to estimate the cost of securing the credits required for the biodiversity certification of the WTC. Assuming the offset site generates 9.3 credits per hectare (as defined by the OEH Credit Converter), the total additional area required to offset impacts is estimated to be 236ha. To secure the offset through a financial contribution rather than purchasing and retiring credits, a 10% margin is applied, the total required offset is therefore estimated to be 262ha by the OEH Credit Converter.

To estimate the cost of the required offset the following assumptions have been made:

1. The offset requirement is 262ha
2. The offset may require up to 3 or 4 sites to be satisfied. For the calculations 4 sites have been assumed. Two sites of approximately 100ha in size, one of approximately 40ha and the other of approximately 22ha. Should offset sites be secured that are larger than this, the cost of the offset is likely to be less than estimated here
3. That the credits required for *Rutidosia heterogama* and Wallum Froglet will be obtained within the 4 sites, and will not require an additional offset site
4. The cost/ha of the offset sites has been estimated at \$10,000/ha for the 100ha site, \$12,500/ha for the 40ha site and \$15,000/ha for the 25ha site. These figures have been determined by reviewing properties for sale in the regions where offsets can be obtained, however prices may differ depending on the physical location of the offset sites and sale conditions at the time of purchase

The results of the credit converter are provided in Appendix 9. The cost of purchasing the four offset sites is estimated at \$2,830,000. The average management cost per hectare (as provided by OEH) is \$3,250/ha, therefore the total cost required for purchase (\$2,830,000) and management (\$852,216) is \$3,682,216. An administration fee is also required, which is calculated at 10% of the purchase price of the properties. Therefore the total cost of the additional offset requirement is \$3,965,216.

The Warnervale Town Centre State Infrastructure Contribution (SIC) was approved by Cabinet in October 2008, and provides for the collection of a \$4M infrastructure contribution for biodiversity offsets. The funding will enable the Office of Environment and Heritage either to acquire land or to set up Biobanking Agreements in order to offset impacts to biodiversity arising from the Warnervale Town Centre development. The provision of a SIC will thus enable the biodiversity certification of the town centre. Priority will be given to using the SIC money for the protection of key conservation lands within the North Wyong Shire Structure Plan Green Corridor. The use of a SIC gives OEH the ability to achieve strategic conservation gains by focussing on areas of regional conservation priority, and the opportunity to deliver long term conservation security.

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Appendix 1: LHSGIF Assessment

A quantitative assessment of the Spotted Gum-Ironbark vegetation community at the WEZ and WTC study sites has been undertaken to determine the presence/absence of the Lower Hunter Spotted Gum-Ironbark Forest (LHSGIF) Endangered Ecological Community (EEC). This assessment contains three separate elements:

1. An assessment against the Final Determination for LHSGIF (NSW Scientific Committee 2005)
2. An assessment against diagnostic species for Spotted Gum-Ironbark forests listed in NPWS (2000) and Bell and Driscoll (2007)
3. An assessment against OEH identification guidelines for LHSGIF

Conclusions in respect to the presence of LHSGIF in the WEZ and WTC study site, including consideration of relevant legal precedents in respect to the definition of EECs have been included.

SECTION 1: LHSGIF FINAL DETERMINATION

The following table provides a quantitative assessment of the Spotted Gum-Ironbark vegetation community at the WEZ and WTC study sites against the Final Determination for Lower Hunter Spotted Gum-Ironbark Forest (NSW Scientific Committee 2005).

| Final determination (NSW Scientific Committee 2005) | Comment |
|--|--|
| <p>1. Lower Hunter Spotted Gum - Ironbark Forest in the Sydney Basin Bioregion is the name given to the ecological community that occurs principally on Permian geology in the central to lower Hunter Valley. The Permian substrates most commonly supporting the community belong to the Dalwood Group, the Maitland Group and the Greta and Tomago Coal Measures, although smaller areas of the community may also occur on the Permian Singleton and Newcastle Coal Measures and the Triassic Narrabeen Group (NSW Department of Mines 1966, 1969). The community is strongly associated with, though not restricted to, the yellow podsolic and solodic soils of the Lower Hunter soil landscapes of Aberdare, Branxton and Neath (Kovac and Lawrie 1991). These substrates are said to produce 'moderately fertile' soils (Kovac and Lawrie 1991).</p> | <p>The WEZ and WTC study sites are not located in the central to lower Hunter Valley and are not located on Permian geology.</p> <p>It is noted that some small areas of the community may occur on Triassic Narrabeen Group geology. Sections of the WEZ and WTC study sites support Triassic Narrabeen Group geology.</p> <p>Soil landscapes at the WEZ site include: Gorokan (GK), Wyong (WY) and Tacoma Swamp (TS). Soil landscapes at the WTC site include: Gorokan (GK), and Woodburys Bridge (WO).</p> <p>Of these, only the Gorokan and Woodsbury Ridge soil landscapes occur on Triassic Narrabeen group geology (Murphy and Tille 1993).</p> |

| Final determination (NSW Scientific Committee 2005) | Comment |
|---|---|
| <p>Lower Hunter Spotted Gum - Ironbark Forest is dominated by <i>Corymbia maculata</i>, (Spotted Gum) and <i>Eucalyptus fibrosa</i> (Broad-leaved Ironbark), while <i>E. punctata</i> (Grey Gum) and <i>E. crebra</i> (Grey Ironbark) occur occasionally. A number of other eucalypt species occur at low frequency, but may be locally common in the community. One of these species, <i>E. canaliculata</i>, intergrades extensively in the area with <i>E. punctata</i>.</p> | <p>Of the seven Biometric vegetation plots surveyed in Spotted Gum-Ironbark vegetation, only four plots (Plots 17, 39, 41 and IB1) had a canopy dominated by <i>Corymbia maculata</i> and <i>Eucalyptus fibrosa</i>.</p> <p>An additional three plots (Plots 20, 30 and 33) had both <i>C. maculata</i> and <i>E. fibrosa</i> present but not as dominant species. And a further three plots (Plots 3, 6 and 9) had a canopy dominated by <i>C. maculata</i> but not <i>E. fibrosa</i>.</p> <p>A range of other canopy species were recorded as dominants and co-dominants in the Spotted Gum-Ironbark vegetation including <i>Angophora costata</i>, <i>E. capitellata</i>, <i>E. globoidea</i> and <i>E. paniculata</i>.</p> <p>It is important to note that the vegetation at both the WEZ and WTC study areas has been variously disturbed from past agricultural and forestry activities which may have affected the canopy composition of the vegetation to some extent.</p> <p>In summary, while there are some minor areas of Spotted Gum-Ironbark vegetation in the WEZ and WTC study areas which have a canopy co-dominated by <i>C. maculata</i> and <i>E. fibrosa</i>, the vast majority of the Spotted Gum-Ironbark vegetation does not support both of these species.</p> <p>The remainder of this assessment will only consider those plots located within mapped Spotted Gum-Ironbark vegetation.</p> |
| <p>The understory is marked by the tall shrub, <i>Acacia parvipinnula</i>, and by the prickly shrubs, <i>Daviesia ulicifolia</i>, <i>Bursaria spinosa</i>, <i>Melaleuca nodosa</i> and <i>Lissanthe strigosa</i>. Other shrubs include <i>Persoonia linearis</i>, <i>Maytenus silvestris</i> and <i>Breynia oblongifolia</i>.</p> | <p><i>Acacia parvipinnula</i> was not recorded in the WEZ or WTC study areas and <i>Lissanthe strigosa</i> was not recorded in any of the plots constituting Spotted Gum-Ironbark Forest.</p> <p><i>Daviesia ulicifolia</i> was recorded in Plot 17 and 30.</p> <p><i>Bursaria spinosa</i> was recorded in Plot 33.</p> <p><i>Melaleuca nodosa</i> was recorded in Plots 17, 30, 33, 39 and 41.</p> <p><i>Maytenus silvestris</i> was recorded in Plot 3.</p> <p><i>Breynia oblongifolia</i> was recorded in Plot 3.</p> <p>According NPWS (2000), <i>Daviesia ulicifolia</i> and <i>Melaleuca nodosa</i>, <i>Maytenus silvestris</i> and <i>Breynia oblongifolia</i> are also common components of Coastal Foothills Spotted Gum - Ironbark Forest (i.e. they are not unique to LHSGIF).</p> |

| Final determination (NSW Scientific Committee 2005) | Comment |
|--|--|
| <p>The ground layer is diverse; frequent species include <i>Cheilanthes sieberi</i>, <i>Cymbopogon refractus</i>, <i>Dianella revoluta</i>, <i>Entolasia stricta</i>, <i>Glycine clandestina</i>, <i>Lepidosperma laterale</i>, <i>Lomandra multiflora</i>, <i>Microlaena stipoides</i>, <i>Pomax umbellata</i>, <i>Pratia purpurascens</i>, <i>Themeda australis</i> and <i>Phyllanthus hirtellus</i> (NPWS 2000, Hill 2003, Bell 2004).</p> | <p>All of these species were recorded within the WEZ and WTC study sites with a range of between 33% and 66% of these species being recorded in each plot.</p> <p>According to Bell and Driscoll (2007), <i>Cymbopogon refractus</i>, <i>Entolasia stricta</i>, <i>Glycine clandestina</i>, <i>Pratia purpurascens</i>, <i>Themeda australis</i> and <i>Phyllanthus hirtellus</i> are also diagnostic species for Coastal Foothills Spotted Gum - Ironbark Forest (i.e. they are not unique to LHSIGIF).</p> |
| <p>In an undisturbed condition the structure of the community is typically open forest. If thinning has occurred, it may take the form of woodland or a dense thicket of saplings, depending on post-disturbance regeneration.</p> | <p>The vegetation recorded in the Spotted Gum-Ironbark Forest ranged from woodland to open forest.</p> |
| <p>Lower Hunter Spotted Gum - Ironbark Forest in the Sydney Basin Bioregion is characterised by the following assemblage of species [list of 55 species]</p> | <p>The percentage of characteristic LHSIGIF species recorded in each plot ranged from 22% (Plot 3) to 36% (Plot 33).</p> <p>The list of characteristic species for LHSIGIF contains 11 species (20%) which were not found to occur in the WEZ or WTC study areas.</p> |
| <p>3. The total species list of the community is considerably larger than that given above, with many species present in only one or two sites or in low abundance. The species composition of a site will be influenced by the size of the site, recent rainfall or drought condition and by its disturbance (including fire and logging) history. The number of species, and the above ground relative abundance of species will change with time since disturbance, and may also change in response to changes in fire regime (including changes in fire frequency). At any one time, above ground individuals of some species may be absent, but the species may be represented below ground in the soil seed banks or as dormant structures such as bulbs, corms, rhizomes, rootstocks or lignotubers. The list of species given above is of vascular plant species, the community also includes micro-organisms, fungi, cryptogamic plants and a diverse fauna, both vertebrate and invertebrate. Some of these components of the community are poorly documented.</p> | <p>No additional comments.</p> |

| Final determination (NSW Scientific Committee 2005) | Comment |
|--|--|
| <p>4. Lower Hunter Spotted Gum - Ironbark Forest in the Sydney Basin Bioregion is restricted to a range of approximately 65 km by 35 km centred on the Cessnock - Beresfield area in the Central and Lower Hunter Valley (NPWS 2000). Within this range, the community was once widespread. A fragmented core of the community still occurs between Cessnock and Beresfield. Remnants occur within the Local Government Areas of Cessnock, Maitland, Singleton, Lake Macquarie, Newcastle, Port Stephens and Dungog but may also occur elsewhere within the bioregion. Outliers are also present on the eastern escarpment of Pokolbin and Corrabare State Forests on Narrabeen Sandstone.</p> | <p>The WEZ and WTC study sites are located in the Wyong LGA and are approximately 30km south of the known distribution of LHSGIF, are geographically isolated from the known distribution of LHSGIF by the Watagan National Park and associated ranges do not occur on the primary geological formation of the community (refer Figure 13).</p> <p>The Final Determination for LHSGIF contains one of the most specific descriptions for the location of the EEC out of all the Final Determinations. It is clear from the determination that the intent of listing is to cover vegetation which occurs in the central and lower Hunter Valley. The fact that the determination states „<i>may occur elsewhere in the bioregion</i>“ is inconsequential to the intent of the listing and is a standard term added to the end of this paragraph. Refer to Section 4. Conclusions and Discussions in which a discussion of legal precedents which apply specifically to locational information in the Final Determination.</p> |
| <p>5. Threatened species recorded within this community include <i>Callistemon linearifolius</i>, <i>Grevillea parviflora</i> subsp. <i>parviflora</i>, <i>Persoonia pauciflora</i>, <i>Rutidosia heterogama</i>, Swift Parrot <i>Lathamus discolor</i> (Saunders 2002), Turquoise Parrot <i>Neophema pulchella</i>, Glossy Black Cockatoo <i>Calyptorhynchus lathamii</i>, Regent Honeyeater <i>Xanthomyza phygria</i>, Black-chinned Honeyeater <i>Melithreptus gularis gularis</i>, Brown Treecreeper <i>Climacteris picumnus victoriae</i>, Powerful Owl <i>Ninox strenua</i>, Koala <i>Phascolarctos cinereus</i>, Yellow-bellied Glider <i>Petaurus australis</i>, Squirrel Glider <i>Petaurus norfolcensis</i> (Smith and Murray 2003), Common Bentwing Bat <i>Miniopterus schreibersii</i> and Eastern Freetail Bat <i>Mormopterus norfolkensis</i>.</p> | <p>A number of these species have been recorded in the study areas including <i>Callistemon linearifolius</i>, <i>Grevillea parviflora</i> subsp. <i>parviflora</i>, <i>Rutidosia heterogama</i>, Glossy Black Cockatoo, Powerful Owl, Koala, Squirrel Glider and Eastern Freetail Bat, however these species are not restricted to LHSGIF and occur elsewhere in the region.</p> |

| Final determination (NSW Scientific Committee 2005) | Comment |
|--|---|
| <p>6. Lower Hunter Spotted Gum - Ironbark Forest in the Sydney Basin Bioregion belongs to a complex of ecological communities that were identified in an analysis of floristic data gathered in a vegetation survey of the Lower Hunter - Central Coast region (NPWS 2000). The methods of survey and analysis employed by NPWS (2000) were found to produce a reliable regional-scale overview of native vegetation in the Lower Hunter - Central Coast area, although limitations apply to fine-scale uses of the map (Nicholls et al. 2003). This analysis, and subsequent analyses based on additional floristic data from the Hunter valley floor (e.g. Hill 2003, Bell 2004, Peake unpubl. data), identified Lower Hunter Spotted Gum - Ironbark Forest as a distinct assemblage of species. <u>Other assemblages that may include Spotted Gum as a dominant species, have geographically distinct distributions outside the core area where this community primarily occurs (Cessnock - Beresfield).</u> These other assemblages include: Coastal Foothills Spotted Gum - Ironbark Forest, Seaham Spotted Gum - Ironbark Forest and Central Hunter Spotted Gum - Ironbark - Grey Box Forest (NPWS 2000). Analysis of additional data from north of the Hunter River and other parts of the Hunter valley indicates the existence of another distinct assemblage dominated by spotted gums and ironbarks on Carboniferous sediments of the footslopes of the Barrington plateau. Lower Hunter Spotted Gum - Ironbark Forest in the Sydney Basin Bioregion belongs to the Hunter - Macleay Dry Sclerophyll Forests vegetation class of Keith (2004).</p> | <p>The Spotted Gum-Ironbark vegetation within the WEZ and WTC study sites has been mapped by NPWS (2000) as Wyong Paperbark Swamp Forest (map unit 43) and Coastal Foothills Spotted Gum – Ironbark Forest (map unit 15). The Wyong Paperbark Swamp Forest is floristically similar to and transitions into Coastal Foothills Spotted Gum – Ironbark Forest in areas of higher relief.</p> <p>Neither of these mapped communities is equivalent to LHSGIF.</p> <p>As these assemblages have <u>geographically distinct distributions outside the core area where this community primarily occurs (Cessnock - Beresfield)</u>, it is considered likely that they form part of the Coastal Foothills Spotted Gum - Ironbark Forest which is not an EEC.</p> |
| <p>7. <i>Eucalyptus fibrosa</i>, <i>Acacia parvipinnula</i> and prickly shrub species occur more frequently or in greater abundance in Lower Hunter Spotted Gum - Ironbark Forest than in any of the other communities mentioned above. Around the margins of its core distribution, Lower Hunter Spotted Gum - Ironbark Forest may intergrade with other communities (e.g Hill 2003). Toward the coast and south, Lower Hunter Spotted Gum - Ironbark Forest may be replaced by Coastal Foothills Spotted Gum - Ironbark Forest, in which <i>Eucalyptus umbra</i>, <i>E. siderophloia</i>, <i>Syncarpia glomulifera</i> and <i>Angophora costata</i> occur more frequently, as do <i>Polyscias sambucifolia</i>, <i>Imperata cylindrica</i> and <i>Pseuderanthemum variabile</i>. Toward the north-east, Lower Hunter Spotted Gum - Ironbark Forest may be replaced by Seaham Spotted Gum - Ironbark Forest, in which <i>Eucalyptus crebra</i>, <i>E. punctata</i>, <i>E. acmenoides</i>, <i>E. moluccana</i> and <i>E. siderophloia</i>, occur more frequently, along with <i>Acacia falcata</i>, <i>A. implexa</i>, <i>Leucopogon juniperinus</i>, <i>Aristida vagans</i> and <i>Pseuderanthemum variabile</i>. Seaham Spotted Gum - Ironbark Forest typically occurs on sediments of Carboniferous age, in contrast to the younger Permian sediments that support Lower Hunter Spotted Gum-Ironbark Forest, although the two communities intergrade where these substrates adjoin (NPWS 2000, Hill 2003). Toward the west and north-west, Lower Hunter Spotted Gum - Ironbark Forest may be replaced by Central Hunter Spotted Gum - Ironbark - Grey Box Forest, which has a higher frequency of <i>Eucalyptus crebra</i> and <i>E. moluccana</i> and a more open grassy understorey distinguished by herbs such as <i>Desmodium varians</i>, <i>Glycine tabacina</i>, <i>Dichondra repens</i>, <i>Brunoniella australis</i> and <i>Calotis lappulacea</i>. On open depressions and drainage flats within the Cessnock-Beresfield area, Lower Hunter Spotted Gum - Ironbark Forest may be replaced locally by Hunter Lowlands Redgum Forest, in which <i>Eucalyptus tereticornis</i>, <i>E. punctata</i>, <i>E. crebra</i> and <i>Angophora floribunda</i>, occur more frequently, as do <i>Breynia oblongifolia</i>, <i>Leucopogon juniperinus</i>, <i>Jacksonia scoparia</i> and <i>Brunoniella australis</i> (NPWS 2000).</p> | <p>While some areas of vegetation in the WEZ and WTC study sites are co-dominated by <i>E. fibrosa</i>, these areas are generally small and not representative of the vegetation community as a whole.</p> <p><i>Acacia parvipinnula</i>, the characteristic midstorey species of LHSGIF was not recorded in the study areas.</p> <p>Spotted-Gum Ironbark vegetation in the WEZ and WTC study sites contain a greater proportion of Coastal Foothills Spotted Gum - Ironbark Forest diagnostic species than for LHSGIF (refer Section 2). Many of the species indicated as more indicative of Coastal Foothills Spotted Gum - Ironbark Forest were frequently recorded in the WEZ and WTC study sites.</p> <p>The Spotted-Gum Ironbark vegetation in the study areas contains a complex mosaic of dominant canopy species which is likely to be attributable to Coastal Foothills Spotted Gum - Ironbark Forest rather than LHSGIF.</p> |

| Final determination (NSW Scientific Committee 2005) | Comment |
|--|--|
| <p>8. Clearing and other disturbances have resulted in a high degree of fragmentation of the community. Four large patches of Lower Hunter Spotted-Gum - Ironbark Forest are estimated to have covered nearly 50 000 ha prior to European settlement, representing 75% of the total distribution. The community is currently mapped as occurring in more than 4 800 fragments, of which more than 4 500 are less than 10 ha in area (House 2003). The four largest patches now cover about 7 000 ha, representing less than one-quarter of the current distribution, or about 10% of the estimated pre-European distribution (House 2003). Clearing of native vegetation is listed as a Key Threatening Process under the Threatened Species Conservation Act (1995).</p> | <p>The Spotted Gum-Ironbark forests remaining in the WEZ and WTC study sites are located in large contiguous patches and have not undergone the scale of clearing and fragmentation as LHSIGIF in the Lower Hunter.</p> |
| <p>9. Using recently updated mapping of extant Lower Hunter Spotted Gum - Ironbark Forest based on fine-scale aerial photograph interpretation of extant woody native vegetation, House (2003) estimated that approximately 26 500 ha of the community remains with its tree canopy cover in a 'substantially unmodified' condition, representing approximately 40% of its pre-European distribution. However, this estimate is based on the collective canopy cover of trees (i.e. where tree canopy cover was estimated to be greater than 20%, the canopy was assumed to be 'unmodified' and not substantially thinned), and does not consider the growth stages of trees that contribute to the cover. Growth stage mapping is available for approximately 6 000 ha of Lower Hunter Spotted Gum Ironbark Forest on public land (RACAC 1995), of which only 3% was assessed as containing a sub-dominance of 'overmature' and 'senescent' tree crowns indicative of old growth forest. Seventy-five per cent of this area was assessed as 'young forest', indicating regeneration from past logging and wildfire. Some areas of Lower Hunter Spotted Gum - Ironbark Forest on private land also reflect a continuing history of degradation. In the Blackhill district, for example, much of the existing vegetation was cleared, and is now largely composed of dense stands of juvenile saplings. This regrowth has since been further affected by clearing and thinning, creation of electricity transmission easements, and ongoing grazing by goats and cattle. In addition, House (2003) estimated that there are a further 4 650 ha of Lower Hunter Spotted Gum - Ironbark Forest with a modified or substantially modified tree canopy cover.</p> | <p>With 40% of its pre-European distribution remaining in a 'substantially unmodified' condition, LHSIGIF is one of the least cleared EECs in the Hunter/Central Rivers CMA region.</p> <p>The Spotted Gum-Ironbark forests remaining in the WEZ and WTC study sites mainly comprise regrowth with very few large hollow bearing, „overmature“ or senescent trees.</p> |
| <p>10. The condition of the understorey has not been mapped systematically. There are no quantitative estimates of the area of the community that retains a substantially unmodified understorey. However, qualitative information suggests that there has been extensive disturbance to the understorey associated with logging, expansion of unplanned tracks and trails, rubbish dumping, off-road vehicle use, arson and weed invasion, even in stands that are currently within a conservation reserve (Bell 2004). These pressures are likely to intensify with the projected increases in the density of the human population within the region (Progress Economics 2004).</p> | <p>The Spotted Gum-Ironbark forests remaining in the WEZ and WTC study sites are considered to be relatively diverse (average of 37 native species per plot) and had a high percent cover of native species (58% average) where weed abundance was relatively low.</p> |

| Final determination (NSW Scientific Committee 2005) | Comment |
|--|---|
| <p>11. Much of the remaining Lower Hunter Spotted Gum - Ironbark Forest in the Sydney Basin Bioregion shows evidence of disturbance. Past logging practices and fire regimes have heavily modified some parts of the community, resulting in a simplified structure and floristics. Production areas of State Forests are actively logged at intensities specified by regulations. Frequent fires (<3 years) dramatically simplify understorey vegetation (Bell 2004). Grazing, uncontrolled human access and associated dumping of solid and garden waste, as well as weed invasion (notably by <i>Lantana camara</i> and <i>Solanum mauritianum</i>, wild tobacco) have degraded the more accessible remnants of the community, while transport corridors and power and communication easements have further fragmented them. As a likely consequence of continuing habitat loss and degradation, local bird observers have noted declines in species associated with spotted gum/ironbark forests, including the Swift Parrot, Regent Honeyeater, Brown Treecreeper, Black-chinned Honeyeater, Diamond Firetail, Turquoise Parrot, Fuscous Honeyeater, Eastern Shrike-tit and Spotted Quail-thrush.</p> | <p>No additional comments.</p> |
| <p>12. Clearing pressures from rural residential and residential subdivisions, industrial developments and new cropping enterprises (e.g. vineyards) continue to threaten the community particularly in Cessnock Local Government Area where the core of this community occurs. Over the past 10 years, demand for housing lots in the Lower Hunter area has nearly doubled from 1 726 in 1991-92 to 3 904 in 2003-04 (Progress Economics 2004). The 'medium' forecast for housing demand in Lower Hunter is 2 500 lots/yr; the current supply of land zoned for housing is 12 000 lots and is projected to meet demand only for the next 5 years. Hence there are substantial pressures for rezoning land for housing within the next 10 years (Progress Economics 2004). A study of the Thornton-Killingworth sub-region projected the population to expand by 169 000 people, requiring 2 600 new dwellings annually over the next 25 years (Parsons Brinckerhoff 2003). Existing proposals to rezone land from rural to rural /residential around the villages of Millfield and Paxton and applications for clearing associated with rural residential and residential developments around Paxton, Bellbird, Ellalong and Mulbring will affect the ecological community. Loss of remnants of Lower Hunter Spotted Gum - Ironbark Forest will be associated with the Cessnock LEP Amendment No 60 - Hunter Economic Zone, Donaldson and Bloomfield coalmine sites at Thornton/Killingworth and F3 to Branxton National Highway link (Ecotone Ecological Consultants 1999, 2000; Connell Wagner 1997). In the Maitland Local Government Area, Hill (2003) assessed Lower Hunter Spotted Gum - Ironbark Forest as exposed to high levels of threat from development, tree dieback and grazing, and under moderate levels of threat from fragmentation, weeds, and fire.</p> | <p>While industrial development is proposed and is likely to have some impact on the Spotted Gum-Ironbark Forests of the WEZ and WTC study sites, none of the comments listed in paragraph 12 of the Final Determination for LHSGIF apply to the study areas.</p> |

| Final determination (NSW Scientific Committee 2005) | Comment |
|--|--------------------------------|
| <p>13. Approximately 1 600 hectares of Lower Hunter Spotted Gum - Ironbark Forest in the Sydney Basin Bioregion occurs within Werakata National Park (Bell 2004). This represents less than 2.5% of the community's modelled pre-1750 distribution (House 2003), is distributed among several separate patches and is predominantly young regrowth forest (Bell 2004). Of an estimated 2 800 ha of the community currently within State Forests, approximately 1 770 ha is excluded from timber harvesting in Forest Management Zone reserves (State Forests of NSW, <i>in litt.</i>), although these areas may be subject to development of service easements, transport infrastructure and mineral exploration. Within the Hunter Employment Zone (HEZ), 460 ha of Lower Hunter Spotted Gum - Ironbark Forest is estimated to occur within zone 7(b) 'Environmental Protection'. However, 7(b) zoning does not exclude development for rural properties (buildings, roads, fences, bushfire hazard reduction) and coal mining.</p> | <p>No additional comments.</p> |
| <p>14. In view of the above the Scientific Committee is of the opinion that Lower Hunter Spotted Gum - Ironbark Forest in the Sydney Basin Bioregion is likely to become extinct in nature in New South Wales unless the circumstances and factors threatening its survival cease to operate, or it might already be extinct.</p> | <p>No additional comments.</p> |

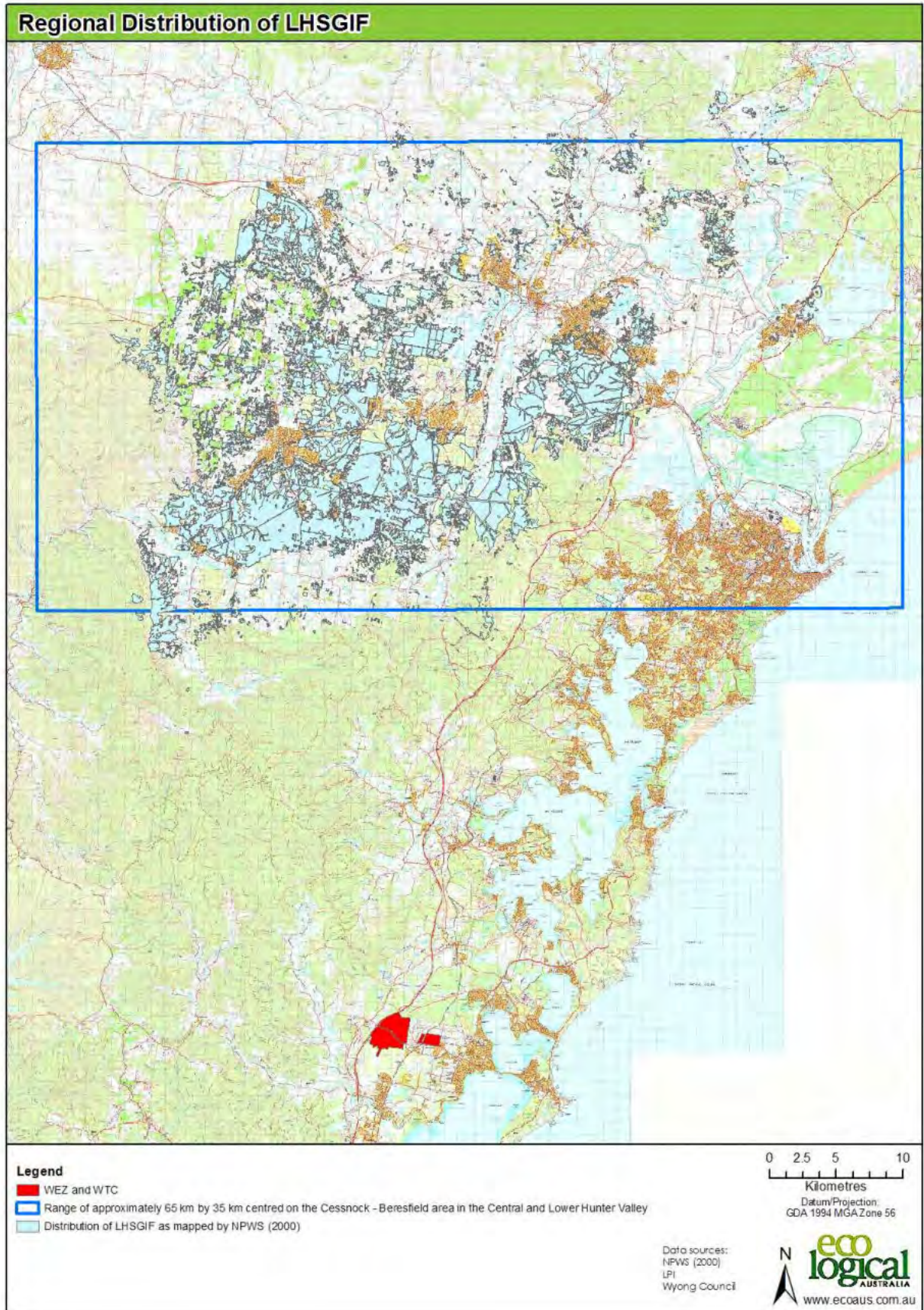


Figure 13: Distribution of LHSGIF

SECTION 2: DIAGNOSTIC SPECIES FOR SPOTTED GUM-IRONBARK FORESTS

In order to further facilitate the assessment of Spotted-Gum Ironbark vegetation at the WEZ and WTC study sites, a quantitative assessment against diagnostic species lists for LHSGIF and Coastal Foothills Spotted Gum-Ironbark Forest was undertaken. All species recorded within 20m x 20m floristic plots within mapped Spotted-Gum Ironbark vegetation at the WEZ and WTC study sites were utilised for this assessment.

The diagnostic approach has been tested in the Land and Environment Court on a number of occasions (refer *Motorplex (Australia) Pty Limited v Port Stephens Council* [2007] NSWLEC 74 and *Nasser v Roads and Traffic Authority; Millstar Holdings Pty Limited v Roads and Traffic Authority* [2006] NSWLEC 181). The diagnostic approach allows for the delineation of vegetation communities based on the number of diagnostic species recorded in any 20m x 20m floristic plot.

Two sources of diagnostic species lists were utilised:

- NPWS (2000). *Vegetation Survey, Classification and Mapping. Lower Hunter and Central Coast Region*. CRA Unit, Sydney Zone, National Parks and Wildlife Service.
- Bell, S. and Driscoll, C. (2007). *Vegetation of the Cessnock-Kurri region, Cessnock LGA, New South Wales: Survey, Classification & Mapping*. Final report to the Department of Environment and Climate Change, Newcastle.

This approach is particularly important as the Final Determination for LHSGIF relies heavily on NPWS (2000) for species composition and distribution information which are essential for the correct identification of this community according to the legislation.

For the assessment against NPWS (2000), two vegetation communities were assessed including map unit 17. *Lower Hunter Spotted Gum - Ironbark Forest* (EEC) and map unit 15. *Coastal Foothills Spotted Gum - Ironbark Forest*. It is noted that some low lying areas at the WEZ study site have been mapped by NPWS (2000) as map unit 43. *Wyong Paperbark Swamp Forest*, which is floristically similar to and transitions into map unit 15.

For the assessment against Bell and Driscoll (2007), two map units were assessed including 17a (i-iii). *Lower Hunter Spotted Gum – Red Ironbark Forest* (EEC) and map unit 15d (i - iv). *Coastal Foothills Spotted Gum-Ironbark Forest*. While the area of interest of Bell and Driscoll (2007) falls outside the WEZ and WTC study sites, the vegetation communities within are synonymous with those of NPWS (2000).

Results of this analysis are presented in Figure 14 and Figure 15. Data in these graphs is presented as a proportion (the total number of diagnostic species observed against the total number of diagnostic species present in each vegetation community). This is due to the relative difference in total number of diagnostic species between each vegetation community.

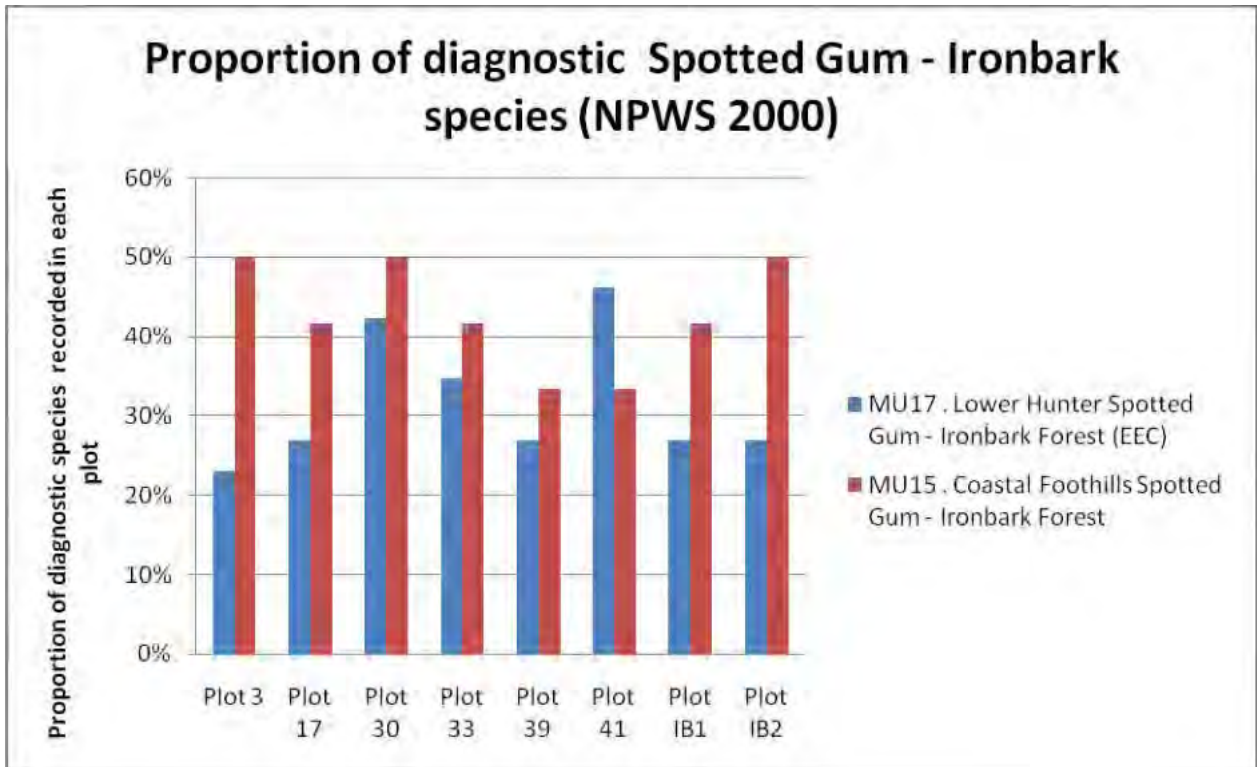


Figure 14: Proportion of Diagnostic Spotted Gum-Ironbark Species (NPWS 2000)

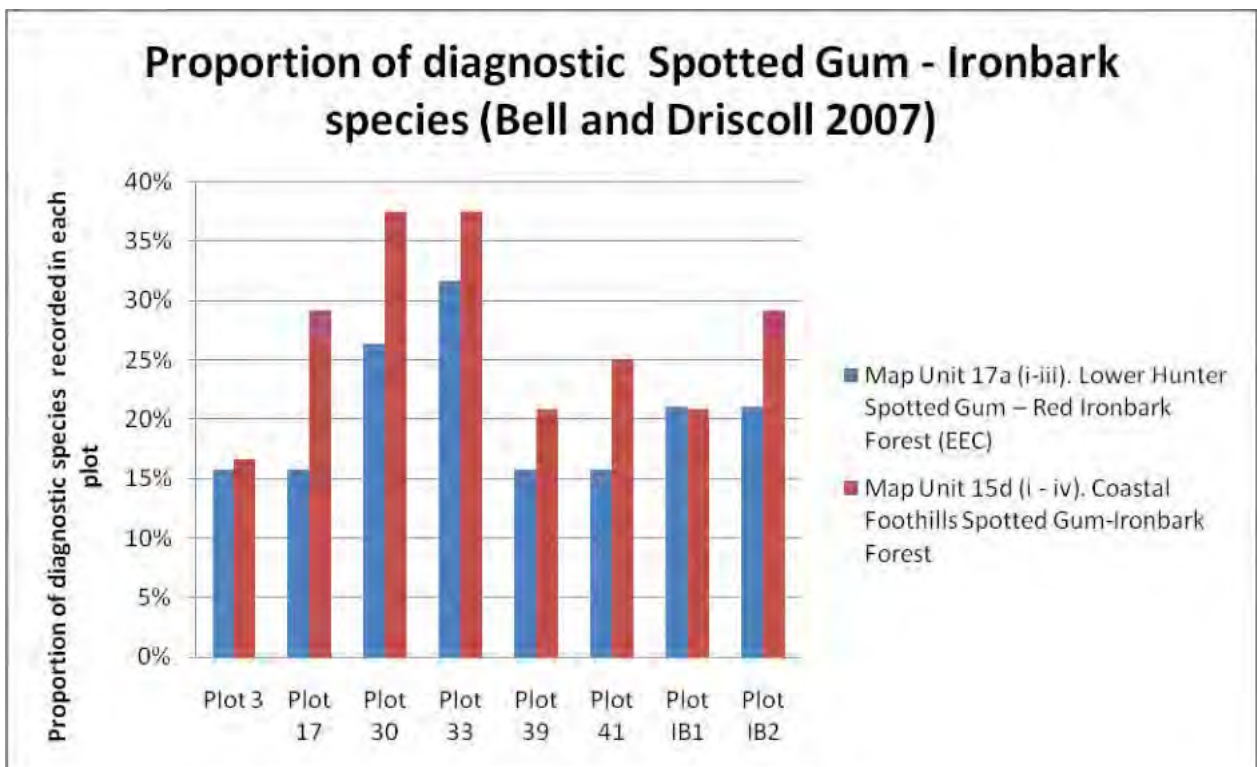


Figure 15: Proportion of Diagnostic Spotted Gum - Ironbark Species (Bell and Driscoll 2007)

Results

As can be seen in Figure 14, the proportion of diagnostic species for each vegetation plot within Spotted Gum Ironbark forests at the WEZ and WTC study sites is higher for *Coastal Foothills Spotted Gum - Ironbark Forest* than for LHSIGIF in all plots except for Plot 41 which is located at the WTC study site. On average 10% more positive diagnostic species were recorded for *Coastal Foothills Spotted Gum - Ironbark Forest* than LHSIGIF when compared against NPWS (2000).

As can be seen in Figure 15, the proportion of diagnostic species for each vegetation plot within Spotted Gum Ironbark forests at the WEZ and WTC study sites is higher for *Coastal Foothills Spotted Gum - Ironbark Forest* than for LHSIGIF in all plots except for Plot IB1 and Plot 3 which have an equal proportion from each community. On average 7% more positive diagnostic species were recorded for *Coastal Foothills Spotted Gum - Ironbark Forest* than *Lower Hunter Spotted Gum – Red Ironbark Forest* when compared against Bell and Driscoll (2007).

The quantitative assessment of diagnostic species has shown that the Spotted Gum Ironbark forests at the WEZ and WTC study sites are more closely aligned to *Coastal Foothills Spotted Gum - Ironbark Forest* than to LHSIGIF. These results align well with the description of *Coastal Foothills Spotted Gum - Ironbark Forest* in NPWS (2000) which states:

“Coastal Foothills Spotted Gum - Ironbark Forest is a moderately tall open forest dominated by Corymbia maculata in combination with one or several ironbark species Eucalyptus siderophloia, E. paniculata or E. fibrosa. E. acmenoides, E. umbra and Syncarpia glomulifera are common associate trees.

The vegetation in the Spotted Gum Ironbark forests at the WEZ and WTC study sites consists of a complex mosaic of vegetation with the constant presence of *Corymbia maculata* (Spotted Gum) and a range of other canopy species including *E. siderophloia*, *E. fibrosa*, *E. umbra*, *E. capitellata* and *Angophora costata*. Within the confines of the WEZ and WTC study sites, the distribution of areas co-dominated by *C. maculata* and *E. fibrosa* within the broader Spotted Gum-Ironbark forests are small.

“The upper mid-storey is often composed of an open stratum of Allocasuarina torulosa. Depending on recent fire history mesic understorey elements can be present or absent. Typically the shrub layer is open with species such as Persoonia linearis, Polyscias sambucifolia, Breynia oblongifolia and Daviesia ulicifolia....In the southern extent around Wyong the shrub layer often contains Melaleuca nodosa. The ground cover is dominated by a number of common grasses including Imperata cylindrica var. major, Entolasia stricta, Themeda australis and Microlaena stipoides var. stipoides.”

Within the WEZ and WTC study sites, these species are all common components of the Spotted Gum-Ironbark forests. While having a similar canopy structure in some small areas, the groundcover species characteristic of LHSIGIF are different, being characterised by:

“the frequent occurrence of Cheilanthes sieberi subsp. sieberi, Entolasia stricta, Pomax umbellata, Pratia purpurascens, Themeda australis, Phyllanthus hirtellus, and Dianella revoluta var. revoluta”

While some of these groundcover species are common to both *Coastal Foothills Spotted Gum - Ironbark Forest* and LHSIGIF, the groundcover species which delineate the vegetation at the WEZ and WTC study sites as *Coastal Foothills Spotted Gum - Ironbark Forest* include the dominant occurrence of *Imperata cylindrica* var. *major* (Blady Grass) and general absence of *Cheilanthes sieberi* subsp. *sieberi*

(Rock Fern), *Pomax umbellata* and *Dianella revoluta* var. *revoluta* (Blue Flax-lily) within the Spotted Gum-Ironbark vegetation.

SECTION 3: OEH IDENTIFICATION GUIDELINES FOR LOWER HUNTER SPOTTED GUM-IRONBARK FOREST

To enable the accurate identification of endangered ecological communities, the Office of Environment and Heritage (OEH, formerly DECCW) have produced EEC identification guidelines for LHSGIF which includes three key characteristics to help identify LHSGIF (DECC 2007, Table 14):

Table 14: DECC LHSGIF Identification “Key Characteristics”

| Characteristic# | Response |
|--|----------|
| Is the site in the central or lower Hunter Valley? | No |
| Is the vegetation open forest or woodland or consist of a dense thicket of saplings? | Yes |
| Does the tree layer contain Spotted Gum or Broad-leaved Ironbark? | Yes |

if you answer yes to the above questions, the area is likely to be Lower Hunter Spotted Gum –Ironbark Forest.

As can be seen from the OEH identification guidelines, one of the key characteristics in determining the presence of LHSGIF is the geographical location of the community – a factor which is outlined on a number of separate occasions in the Final Determination and stated in the *Threatened Species Act 1995* (TSC Act), which defines an „ecological community“ as „**an assemblage of species occupying a particular area**“ (s 4(1) of the Act).

In the case of LHSGIF, the particular area in question is clearly the Lower Hunter Valley (as included in the title of the ecological community itself) and specifically within a range of approximately 65 km by 35 km centred on the Cessnock - Beresfield area).

As the Final Determination for LHSGIF (NSW Scientific Committee 2005) clearly defines the assemblage of species and the particular area of occupancy (i.e. central to lower Hunter Valley and more specifically a range of approximately 65 km by 35 km centred on the Cessnock - Beresfield area), it can be concluded that the Spotted Gum-Ironbark Forests at the WEZ and WTC study sites do not constitute the LHSGIF EEC based purely on the location of the sites.

SECTION 4: CONCLUSION AND DISCUSSION

Despite some areas of Spotted Gum-Ironbark forests within the WEZ and WTC study sites being dominated by either *C. maculata* or *E. fibrosa* or both, there are a number of factors to suggest that the LHSGIF EEC does not occur, including:

- The WEZ and WTC study sites are geographically isolated from the known distribution of LHSGIF (NPWS 2000) by the Watagan National Park and associated mountain ranges and are located outside the core area where this community occurs (Cessnock – Beresfield);
- The WEZ and WTC study sites do not occur on the primary geological formation identified in the Final Determination (Permian);
- Many of the LHSGIF „characteristic“ species are also common components of the Coastal Foothills Spotted Gum - Ironbark Forest (i.e. they are not unique to LHSGIF);
- The vegetation within the Spotted Gum-Ironbark forests of the WEZ and WTC study sites has a greater proportion of diagnostic species for Coastal Foothills Spotted Gum - Ironbark Forest than LHSGIF;

- While some areas of vegetation in the study are dominated by *C. maculata* and *E. fibrosa*, these areas are generally small and are not representative of the remainder of the Spotted Gum-Ironbark vegetation in the WEZ and WTC study sites. The Spotted Gum-Ironbark vegetation in the study areas constitutes a complex mosaic of canopy species which is attributable to Coastal Foothills Spotted Gum - Ironbark Forest. Common co-occurring species include *Angophora costata*, *E. amplifolia*, *E. capitellata*, *E. globoidea*, *E. paniculata* and *E. resinifera* subsp. *resinifera*. The description of Coastal Foothills Spotted Gum - Ironbark Forest in NPWS (2000) is a testament to this.
- The main risks to the community associated with the listing of LHSGIF do not apply to the WEZ or WTC study areas as they are specifically located in the lower Hunter Valley (Paragraph 12 of the Final Determination).

To further support these main conclusions, a number of legal precedents have been set in relation to the definition and identification of EECs. These are outlined below.

In the case of Motorplex (Australia) Pty Limited v Port Stephens Council [2007] NSWLEC 74, Justice Preston found that:

*“12 Each of the Final Determinations describe the endangered ecological communities using a variety of descriptors but of **particular relevance** are the **floristic descriptors** of the **assemblage of species** constituting the ecological communities and the **locational descriptors** of each ecological community. This accords with the definition of an “ecological community” as “**an assemblage of species occupying a particular area**” (s 4(1) of the Act).”*

This finding is of particular relevance, as the Final Determination for LHSGIF (NSW Scientific Committee 2005) clearly defines the assemblage of species and the particular area of occupancy (i.e. central to lower Hunter Valley and more specifically a range of approximately 65 km by 35 km centred on the Cessnock - Beresfield area).

In the case of VAW (Kurri Kurri) Pty Ltd v Scientific Committee (Established under s127 of the Threatened Species Conservation Act 1995) [2003] NSWCA 297, Justice Spigelman found that:

*“7 The terminology directly relevant to the present case is the definition of an ecological community as “**an assemblage of species in a particular area**”. The use of the word “assemblage” does not suggest that either the nomination of species or identification of an area requires a high degree of specificity: c/f *Genkem Pty Ltd v Environment Protection Authority* (1994) 35 NSWLR 33 at 44. **To satisfy the requirement of certainty to an appropriate standard, the terms of the Scientific Committee’s final determination must enable a citizen to decide whether a specific location falls within it.**”*

Justice Spigelman clearly states that in order to obtain certainty, the final determination must enable a citizen to decide whether a specific location falls within it. In the case of LHSGIF, the final determination clearly states the location of the ecological community. Justice Spigelman also found that:

*“8 In my opinion, the Kurri Sand Swamp Woodland (“KSSW”) final determination satisfies the requirement of reasonable certainty of expression. As to the “particular area” to which it applies, the community must be found on certain specified soils in the Sydney Basin Bioregion. It was noted that the community had been known to occur in the Kurri-Kurri – Cessnock area in the Cessnock local government area, **but may occur elsewhere in that general area**, but not in the specific local government area. **The restriction to the Kurri-Kurri - Cessnock area is, in***

my opinion, sufficient. The assemblage of species listed must be found within this area and on the type of soils identified, in order to constitute the KSSW.

This additional finding is of further significance, as the common addition to the distribution information in the Final Determination of “may occur elsewhere” is inconsequential when the area of occupancy is so well defined, as in the case of LHSGIF.

So in order for vegetation to be identified as LHSGIF, the vegetation must be characteristic of LHSGIF (refer section 3), must be found within the central to lower Hunter Valley (more specifically a range of approximately 65 km by 35 km centred on the Cessnock - Beresfield area) and occur on Permian geology. The findings of Justice Spigelman align well with the OEH identification guidelines for LHSGIF and the definition of an ecological community as an “*an assemblage of species occupying a particular area*”.

The relatively small areas of vegetation within the Spotted Gum-Ironbark Forests at the WEZ and WTC study sites dominated by *C. maculata* and *E. fibrosa* may very well constitute a unique assemblage of species in the Wyong and central coast region, although they are more likely to represent variation within the Coastal Foothills Spotted Gum - Ironbark Forest vegetation community. The Spotted Gum-Ironbark Forests at the WEZ and WTC cannot be included within LHSGIF under the current definition of the ecological community for the reasons outlined in this assessment.

Note that it is also stated by Bell and Murray (2007), that:

“Data analysis has clearly shown that the Spotted Gum forests from the Warnervale area is more akin to the Coastal Foothills Spotted Gum – Ironbark Forest of NPWS (2000), and in fact form a distinct sub-group of that community which may well be differentiated out as a distinct community with further work (S. Bell, unpubl. data).”

Appendix 2: Species Predicted and Requiring Survey

SPECIES PREDICTED





| Common Name | Species Name | TSC Act | EPBC Act | Present on Site |
|---|---|---------|----------|------------------|
| Barking Owl | <i>Ninox connivens</i> | V | - | |
| Black-chinned Honeyeater (eastern subspecies) | <i>Melithreptus gularis gularis</i> | V | - | |
| Brown Treecreeper (eastern subspecies) | <i>Climacteris picumnus victoriae</i> | V | - | |
| Bush Stone-curlew | <i>Burhinus grallarius</i> | E | - | |
| Diamond Firetail | <i>Stagonopleura guttata</i> | V | - | |
| Eastern Bentwing-bat | <i>Miniopterus schreibersii oceanensis</i> | V | - | |
| Eastern Cave Bat | <i>Vespadelus troughtoni</i> | V | - | |
| Eastern False Pipistrelle | <i>Falsistrellus tasmaniensis</i> | V | - | |
| Eastern Freetail-bat | <i>Mormopterus norfolkensis</i> | V | - | |
| Eastern Pygmy-possum | <i>Cercartetus nanus</i> | V | - | |
| Glossy Black-cockatoo | <i>Calyptorhynchus lathami</i> | V | - | |
| Golden-tipped Bat | <i>Kerivoula papuensis</i> | V | - | |
| Greater Broad-nosed Bat | <i>Scoteanax rueppellii</i> | V | - | |
| Grey-crowned Babbler (eastern subspecies) | <i>Pomatostomus temporalis temporalis</i> | V | - | |
| Grey-headed Flying-fox | <i>Pteropus poliocephalus</i> | V | V | Foraging Habitat |
| Koala | <i>Phascolarctos cinereus</i> | V | - | |
| Large-footed Myotis | <i>Myotis macropus (formally Myotis adversus)</i> | V | - | |
| Little Bentwing-bat | <i>Miniopterus australis</i> | V | - | |
| Little Lorikeet | <i>Glossopsitta pusilla</i> | V | - | |
| Long-nosed Potoroo | <i>Potorous tridactylus</i> | V | V | |
| Masked Owl | <i>Tyto novaehollandiae</i> | V | - | Yes |
| Painted Honeyeater | <i>Grantiella picta</i> | V | - | |
| Powerful Owl | <i>Ninox strenua</i> | V | - | Yes |
| Regent Honeyeater | <i>Xanthomyza phrygia</i> | CE | E | |
| Rose-crowned Fruit-dove | <i>Ptilinopus regina</i> | V | - | |
| Scarlet Robin | <i>Petroica boodang</i> | V | - | |
| Sooty Owl | <i>Tyto tenebricosa</i> | V | - | |
| Speckled Warbler | <i>Pyrrholaemus saggitatus</i> | V | - | |
| Spotted-tailed Quoll | <i>Dasyurus maculatus</i> | V | E | |
| Squirrel Glider | <i>Petaurus norfolcensis</i> | V | - | Yes |
| Stephens' Banded Snake | <i>Hoplocephalus stephensii</i> | V | - | |
| Superb Fruit-dove | <i>Ptilinopus superbus</i> | V | - | |
| Swift Parrot | <i>Lathamus discolor</i> | E | E | |
| Turquoise Parrot | <i>Neophema pulchella</i> | V | - | |
| Yellow-bellied Glider | <i>Petaurus australis</i> | V | - | |
| Yellow-bellied Sheath-tail-bat | <i>Saccolaimus flaviventris</i> | V | - | |

SPECIES REQUIRING SURVEY

| Common Name | Species Name | TSC Act | EPBC Act | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec | Surveyed at Correct Time | Present on Site |
|---|--|---------|----------|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|--------------------------|-----------------|
| Black Bittern | <i>Ixobrychus flavicollis</i> | V | - | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Y | |
| Black-necked Stork | <i>Ephippiorhynchus asiaticus</i> | E | - | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Y | |
| Broad-headed Snake | <i>Hoplocephalus bungaroides</i> | E | V | | | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | | Y | |
| Brush-tailed Phascogale | <i>Phascogale tapoatafa</i> | V | - | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Y | |
| Comb-crested Jacana | <i>Irediparra gallinacea</i> | V | - | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Y | |
| Common Planigale | <i>Planigale maculata</i> | V | - | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Y | |
| Eastern Chestnut Mouse | <i>Pseudomys gracilicaudatus</i> | V | - | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Y | |
| Gang-gang Cockatoo | <i>Callocephalon fimbriatum</i> | V | - | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Y | |
| Giant Barred Frog | <i>Mixophyes iteratus</i> | E | E | Yes | Yes | Yes | Yes | Yes | | | | | Yes | Yes | Yes | Y | |
| Giant Burrowing Frog | <i>Heleioporus australiacus</i> | V | V | Yes | Yes | Yes | Yes | Yes | | | | Yes | Yes | Yes | Yes | Y | |
| Green and Golden Bell Frog | <i>Litoria aurea</i> | E | V | Yes | Yes | Yes | | | | | Yes | Yes | Yes | Yes | Yes | Y | |
| Green-thighed Frog | <i>Litoria brevipalmata</i> | V | - | Yes | Yes | Yes | | | | | | | Yes | Yes | Yes | Y | |
| Grey-headed Flying-fox (Breeding Habitat) | <i>Pteropus poliocephalus (Breeding Habitat)</i> | V | V | Yes | Yes | Yes | Yes | Yes | | | | Yes | Yes | Yes | Yes | Y | |
| Large-footed Myotis (Breeding Habitat) | <i>Myotis macropus (formally Myotis adversus) (Breeding Habitat)</i> | V | - | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Y | |
| Little Eagle | <i>Hieraaetus morphnoides</i> | V | - | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Y | |
| Littlejohn's Tree Frog | <i>Litoria littlejohni</i> | V | V | Yes | Yes | | | | | | | Yes | Yes | Yes | Yes | Y | |
| Osprey | <i>Pandion haliaetus</i> | V | - | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Y | |
| Pale-headed Snake | <i>Hoplocephalus bitorquatus</i> | V | - | Yes | Yes | Yes | Yes | | | | | | Yes | Yes | Yes | Y | |
| Parma Wallaby | <i>Macropus parma</i> | V | - | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Y | |

| Common Name | Species Name | TSC Act | EPBC Act | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec | Surveyed at Correct Time | Present on Site |
|---|--|---------|----------|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----------------------------------|-----------------|
| Red-crowned Toadlet | <i>Pseudophryne australis</i> | V | - | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Y | |
| Square-tailed Kite | <i>Lophoictinia isura</i> | V | - | Yes | Yes | Yes | | | | | | Yes | Yes | Yes | Yes | Y | |
| Stuttering Barrred Frog | <i>Mixophyes balbus</i> | E | V | Yes | Yes | Yes | Yes | Yes | | | | Yes | Yes | Yes | Yes | Y | |
| Wallum Froglet | <i>Crinia tinnula</i> | V | - | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | | | | Yes | N-Reconnaissance and flora survey | Yes |
| Biconvex Paperbark | <i>Melaleuca biconvexa</i> | V | V | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Y | |
| Black-eyed Susan | <i>Tetradlea juncea</i> | V | V | | | | | | | Yes | Yes | Yes | Yes | Yes | Yes | Y | |
| Bynoe's Wattle | <i>Acacia bynoeana</i> | E | V | Yes | Yes | Yes | | | | | | Yes | Yes | Yes | Yes | Y | |
| Caladenia porphyrea | <i>Caladenia porphyrea</i> | E | - | | | | | | | | | Yes | Yes | | | Y | |
| Cut-leaf Mint-bush | <i>Prostanthera askania</i> | E | E | | | | | | | | | Yes | Yes | Yes | Yes | Y | |
| Diuris bracteata | <i>Diuris bracteata</i> | E | E | | | | | | | | Yes | Yes | | | | Y | |
| Eucalyptus parramattensis subsp. parramattensis population, Wyong and Lake Macquarie local government areas | <i>Eucalyptus parramattensis subsp. parramattensis - endangered population</i> | EP | V | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Y | |
| Grove's Paperbark | <i>Melaleuca groveana</i> | V | - | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Y | |
| Heath Wrinklewort | <i>Rutidosia heterogama</i> | V | V | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Y | Yes |
| Leafless Tongue Orchid | <i>Cryptostylis hunteriana</i> | V | V | Yes | Yes | | | | | | | | | Yes | Yes | Y | |
| Maundia triglochinos | <i>Maundia triglochinos</i> | V | - | Yes | Yes | Yes | | | | | | | | Yes | Yes | Y | |
| Netted Bottlebrush | <i>Callistemon linearifolius</i> | V | - | Yes | Yes | Yes | | | | | | Yes | Yes | Yes | Yes | Y | |

| Common Name | Species Name | TSC Act | EPBC Act | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec | Surveyed at Correct Time | Present on Site |
|---------------------------|--|---------|----------|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|---------------------------|-----------------|
| Rough Double Tail | <i>Diuris praecox</i> | V | V | | | | | | | Yes | Yes | | | | | N- Reconnaissance only | |
| Small-flower Grevillea | <i>Grevillea parviflora subsp. parviflora</i> | V | V | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Y | |
| Tessellated Spider Orchid | <i>Caladenia/Arachnorchis tessellata</i> | E | V | | | | | | | | | Yes | Yes | | | Y | |
| Tetrateca glandulosa | <i>Tetrateca glandulosa</i> | V | V | | | | | | | Yes | Yes | Yes | Yes | Yes | | Y | |
| Thick-leaf Star-hair | <i>Astrotricha crassifolia</i> | V | V | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Y | |
| Variable Midge Orchid | <i>Genoplesium insignis</i> | E | - | | | | | | | | | Yes | Yes | | | Y | |
| White-flowered Wax Plant | <i>Cynanchum elegans</i> | E | E | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Y | |
| Wyong Sun Orchid | <i>Thelymitra sp. „Adorata“ (B. Branwhite JAJ1030) J. Jeanes ined.</i> | CE | - | | | | | | | | | Yes | Yes | | | Y | |

-  ELA transects/plots and targeted flora survey (Bell and Murray 2004)
-  Targeted flora and fauna survey (Bell and Murray 2004)
-  Targeted flora survey (Bell and Murray 2004)
-  Site reconnaissance (Bell and Murray 2004)

Appendix 3: Landscape Tg Calculations

| Veg Type | Veg Type Name | Common Name | Scientific Name | Tg Value |
|----------|--|---|--|-------------|
| HU514 | Blackbutt - Turpentine open forest of the foothills of the North Coast | Eastern Bentwing-bat | Miniopterus schreibersii oceanensis | 0.75 |
| HU514 | Blackbutt - Turpentine open forest of the foothills of the North Coast | Eastern False Pipistrelle | Falsistrellus tasmaniensis | 0.45 |
| HU514 | Blackbutt - Turpentine open forest of the foothills of the North Coast | Eastern Freetail-bat | Mormopterus norfolkensis | 0.45 |
| HU514 | Blackbutt - Turpentine open forest of the foothills of the North Coast | Eastern Pygmy-possum | Cercartetus nanus | 0.5 |
| HU514 | Blackbutt - Turpentine open forest of the foothills of the North Coast | Glossy Black-cockatoo | Calyptorhynchus lathami | 0.55 |
| HU514 | Blackbutt - Turpentine open forest of the foothills of the North Coast | Golden-tipped Bat | Kerivoula papuensis | 0.4 |
| HU514 | Blackbutt - Turpentine open forest of the foothills of the North Coast | Greater Broad-nosed Bat | Scoteanax rueppellii | 0.45 |
| HU514 | Blackbutt - Turpentine open forest of the foothills of the North Coast | Grey-headed Flying-fox | Pteropus poliocephalus | 0.93 |
| HU514 | Blackbutt - Turpentine open forest of the foothills of the North Coast | Koala | Phascolarctos cinereus | 0.83 |
| HU514 | Blackbutt - Turpentine open forest of the foothills of the North Coast | Large-footed Myotis | Myotis macropus (formally Myotis adversus) | 0.4 |
| HU514 | Blackbutt - Turpentine open forest of the foothills of the North Coast | Little Bentwing-bat | Miniopterus australis | 0.75 |
| HU514 | Blackbutt - Turpentine open forest of the foothills of the North Coast | Little Lorikeet | Glossopsitta pusilla | 0.58 |
| HU514 | Blackbutt - Turpentine open forest of the foothills of the North Coast | Long-nosed Potoroo | Potorous tridactylus | 0.75 |
| HU514 | Blackbutt - Turpentine open forest of the foothills of the North Coast | Masked Owl | Tyto novaehollandiae | 0.33 |
| HU514 | Blackbutt - Turpentine open forest of the foothills of the North Coast | Powerful Owl | Ninox strenua | 0.33 |
| HU514 | Blackbutt - Turpentine open forest of the foothills of the North Coast | Regent Honeyeater | Xanthomyza phrygia | 0.75 |
| HU514 | Blackbutt - Turpentine open forest of the foothills of the North Coast | Spotted-tailed Quoll | Dasyurus maculatus | 0.35 |
| HU514 | Blackbutt - Turpentine open forest of the foothills of the North Coast | Squirrel Glider | Petaurus norfolkensis | 0.45 |
| HU514 | Blackbutt - Turpentine open forest of the foothills of the North Coast | Stephens' Banded Snake | Hoplocephalus stephensii | 0.3 |
| HU514 | Blackbutt - Turpentine open forest of the foothills of the North Coast | Swift Parrot | Lathamus discolor | 0.75 |
| HU514 | Blackbutt - Turpentine open forest of the foothills of the North Coast | Yellow-bellied Glider | Petaurus australis | 0.43 |
| HU514 | Blackbutt - Turpentine open forest of the foothills of the North Coast | Yellow-bellied Sheathtail-bat | Saccolaimus flaviventris | 0.45 |
| | | | Average | 0.54 |
| HU621 | Smooth-barked Apple - Red Bloodwood open forest on coastal plains on the Central Coast, Sydney Basin | Barking Owl | Ninox connivens | 0.33 |
| HU621 | Smooth-barked Apple - Red Bloodwood open forest on coastal plains on the Central Coast, Sydney Basin | Black-chinned Honeyeater (eastern subspecies) | Melithreptus gularis gularis | 0.75 |
| HU621 | Smooth-barked Apple - Red Bloodwood open forest on coastal plains on the Central Coast, Sydney Basin | Brown Treecreeper (eastern subspecies) | Climacteris picumnus victoriae | 0.5 |
| HU621 | Smooth-barked Apple - Red Bloodwood open forest on coastal plains on the Central Coast, Sydney Basin | Bush Stone-curlew | Burhinus grallarius | 0.4 |
| HU621 | Smooth-barked Apple - Red Bloodwood open forest on coastal plains on the Central Coast, Sydney Basin | Eastern Bentwing-bat | Miniopterus schreibersii oceanensis | 0.75 |
| HU621 | Smooth-barked Apple - Red Bloodwood open forest on coastal plains on the Central Coast, Sydney Basin | Eastern False Pipistrelle | Falsistrellus tasmaniensis | 0.45 |

| Veg Type | Veg Type Name | Common Name | Scientific Name | Tg Value |
|----------|--|---|--|----------|
| HU621 | Smooth-barked Apple - Red Bloodwood open forest on coastal plains on the Central Coast, Sydney Basin | Eastern Freetail-bat | Mormopterus norfolkensis | 0.45 |
| HU621 | Smooth-barked Apple - Red Bloodwood open forest on coastal plains on the Central Coast, Sydney Basin | Eastern Pygmy-possum | Cercartetus nanus | 0.5 |
| HU621 | Smooth-barked Apple - Red Bloodwood open forest on coastal plains on the Central Coast, Sydney Basin | Glossy Black-cockatoo | Calyptorhynchus lathami | 0.55 |
| HU621 | Smooth-barked Apple - Red Bloodwood open forest on coastal plains on the Central Coast, Sydney Basin | Golden-tipped Bat | Kerivoula papuensis | 0.4 |
| HU621 | Smooth-barked Apple - Red Bloodwood open forest on coastal plains on the Central Coast, Sydney Basin | Greater Broad-nosed Bat | Scoteanax rueppellii | 0.45 |
| HU621 | Smooth-barked Apple - Red Bloodwood open forest on coastal plains on the Central Coast, Sydney Basin | Grey-crowned Babbler (eastern subspecies) | Pomatostomus temporalis temporalis | 0.75 |
| HU621 | Smooth-barked Apple - Red Bloodwood open forest on coastal plains on the Central Coast, Sydney Basin | Grey-headed Flying-fox | Pteropus poliocephalus | 0.93 |
| HU621 | Smooth-barked Apple - Red Bloodwood open forest on coastal plains on the Central Coast, Sydney Basin | Koala | Phascolarctos cinereus | 0.83 |
| HU621 | Smooth-barked Apple - Red Bloodwood open forest on coastal plains on the Central Coast, Sydney Basin | Large-footed Myotis | Myotis macropus (formally Myotis adversus) | 0.4 |
| HU621 | Smooth-barked Apple - Red Bloodwood open forest on coastal plains on the Central Coast, Sydney Basin | Little Bentwing-bat | Miniopterus australis | 0.75 |
| HU621 | Smooth-barked Apple - Red Bloodwood open forest on coastal plains on the Central Coast, Sydney Basin | Little Lorikeet | Glossopsitta pusilla | 0.58 |
| HU621 | Smooth-barked Apple - Red Bloodwood open forest on coastal plains on the Central Coast, Sydney Basin | Masked Owl | Tyto novaehollandiae | 0.33 |
| HU621 | Smooth-barked Apple - Red Bloodwood open forest on coastal plains on the Central Coast, Sydney Basin | Painted Honeyeater | Grantiella picta | 0.75 |
| HU621 | Smooth-barked Apple - Red Bloodwood open forest on coastal plains on the Central Coast, Sydney Basin | Powerful Owl | Ninox strenua | 0.33 |
| HU621 | Smooth-barked Apple - Red Bloodwood open forest on coastal plains on the Central Coast, Sydney Basin | Regent Honeyeater | Xanthomyza phrygia | 0.75 |
| HU621 | Smooth-barked Apple - Red Bloodwood open forest on coastal plains on the Central Coast, Sydney Basin | Scarlet Robin | Petroica boodang | 0.6 |
| HU621 | Smooth-barked Apple - Red Bloodwood open forest on coastal plains on the Central Coast, Sydney Basin | Spotted-tailed Quoll | Dasyurus maculatus | 0.35 |
| HU621 | Smooth-barked Apple - Red Bloodwood open forest on coastal plains on the Central Coast, Sydney Basin | Squirrel Glider | Petaurus norfolcensis | 0.45 |
| HU621 | Smooth-barked Apple - Red Bloodwood open forest on coastal plains on the Central Coast, Sydney Basin | Swift Parrot | Lathamus discolor | 0.75 |
| HU621 | Smooth-barked Apple - Red Bloodwood open forest on coastal plains on the Central Coast, Sydney Basin | Turquoise Parrot | Neophema pulchella | 0.55 |
| HU621 | Smooth-barked Apple - Red Bloodwood open forest on coastal plains on the Central Coast, Sydney Basin | Yellow-bellied Glider | Petaurus australis | 0.43 |
| HU621 | Smooth-barked Apple - Red Bloodwood open forest on coastal plains on the Central Coast, Sydney Basin | Yellow-bellied Sheath-tail-bat | Saccolaimus flaviventris | 0.45 |

| Veg Type | Veg Type Name | Common Name | Scientific Name | Tg Value |
|----------|---|---|--|-------------|
| | | | Average | 0.55 |
| HU631 | Spotted Gum - Grey Ironbark open forest on the foothills of the Central Coast, Sydney Basin | Barking Owl | Ninox connivens | 0.33 |
| HU631 | Spotted Gum - Grey Ironbark open forest on the foothills of the Central Coast, Sydney Basin | Black-chinned Honeyeater (eastern subspecies) | Melithreptus gularis gularis | 0.75 |
| HU631 | Spotted Gum - Grey Ironbark open forest on the foothills of the Central Coast, Sydney Basin | Brown Treecreeper (eastern subspecies) | Climacteris picumnus victoriae | 0.5 |
| HU631 | Spotted Gum - Grey Ironbark open forest on the foothills of the Central Coast, Sydney Basin | Bush Stone-curlew | Burhinus grallarius | 0.4 |
| HU631 | Spotted Gum - Grey Ironbark open forest on the foothills of the Central Coast, Sydney Basin | Diamond Firetail | Stagonopleura guttata | 0.75 |
| HU631 | Spotted Gum - Grey Ironbark open forest on the foothills of the Central Coast, Sydney Basin | Eastern Bentwing-bat | Miniopterus schreibersii oceanensis | 0.75 |
| HU631 | Spotted Gum - Grey Ironbark open forest on the foothills of the Central Coast, Sydney Basin | Eastern Cave Bat | Vespadelus troughtoni | 0.75 |
| HU631 | Spotted Gum - Grey Ironbark open forest on the foothills of the Central Coast, Sydney Basin | Eastern False Pipistrelle | Falsistrellus tasmaniensis | 0.45 |
| HU631 | Spotted Gum - Grey Ironbark open forest on the foothills of the Central Coast, Sydney Basin | Eastern Freetail-bat | Mormopterus norfolkensis | 0.45 |
| HU631 | Spotted Gum - Grey Ironbark open forest on the foothills of the Central Coast, Sydney Basin | Eastern Pygmy-possum | Cercartetus nanus | 0.5 |
| HU631 | Spotted Gum - Grey Ironbark open forest on the foothills of the Central Coast, Sydney Basin | Glossy Black-cockatoo | Calyptorhynchus lathami | 0.55 |
| HU631 | Spotted Gum - Grey Ironbark open forest on the foothills of the Central Coast, Sydney Basin | Golden-tipped Bat | Kerivoula papuensis | 0.4 |
| HU631 | Spotted Gum - Grey Ironbark open forest on the foothills of the Central Coast, Sydney Basin | Greater Broad-nosed Bat | Scoteanax rueppellii | 0.45 |
| HU631 | Spotted Gum - Grey Ironbark open forest on the foothills of the Central Coast, Sydney Basin | Grey-crowned Babbler (eastern subspecies) | Pomatostomus temporalis temporalis | 0.75 |
| HU631 | Spotted Gum - Grey Ironbark open forest on the foothills of the Central Coast, Sydney Basin | Grey-headed Flying-fox | Pteropus poliocephalus | 0.93 |
| HU631 | Spotted Gum - Grey Ironbark open forest on the foothills of the Central Coast, Sydney Basin | Koala | Phascolarctos cinereus | 0.83 |
| HU631 | Spotted Gum - Grey Ironbark open forest on the foothills of the Central Coast, Sydney Basin | Large-footed Myotis | Myotis macropus (formally Myotis adversus) | 0.4 |
| HU631 | Spotted Gum - Grey Ironbark open forest on the foothills of the Central Coast, Sydney Basin | Little Bentwing-bat | Miniopterus australis | 0.75 |
| HU631 | Spotted Gum - Grey Ironbark open forest on the foothills of the Central Coast, Sydney Basin | Little Lorikeet | Glossopsitta pusilla | 0.58 |
| HU631 | Spotted Gum - Grey Ironbark open forest on the foothills of the Central Coast, Sydney Basin | Masked Owl | Tyto novaehollandiae | 0.33 |
| HU631 | Spotted Gum - Grey Ironbark open forest on the foothills of the Central Coast, Sydney Basin | Painted Honeyeater | Grantiella picta | 0.75 |

| Veg Type | Veg Type Name | Common Name | Scientific Name | Tg Value |
|----------|--|--|-------------------------------------|-------------|
| HU631 | Spotted Gum - Grey Ironbark open forest on the foothills of the Central Coast, Sydney Basin | Powerful Owl | Ninox strenua | 0.33 |
| HU631 | Spotted Gum - Grey Ironbark open forest on the foothills of the Central Coast, Sydney Basin | Regent Honeyeater | Xanthomyza phrygia | 0.75 |
| HU631 | Spotted Gum - Grey Ironbark open forest on the foothills of the Central Coast, Sydney Basin | Scarlet Robin | Petroica boodang | 0.6 |
| HU631 | Spotted Gum - Grey Ironbark open forest on the foothills of the Central Coast, Sydney Basin | Speckled Warbler | Pyrrholaemus saggitatus | 0.4 |
| HU631 | Spotted Gum - Grey Ironbark open forest on the foothills of the Central Coast, Sydney Basin | Spotted-tailed Quoll | Dasyurus maculatus | 0.35 |
| HU631 | Spotted Gum - Grey Ironbark open forest on the foothills of the Central Coast, Sydney Basin | Squirrel Glider | Petaurus norfolcensis | 0.45 |
| HU631 | Spotted Gum - Grey Ironbark open forest on the foothills of the Central Coast, Sydney Basin | Swift Parrot | Lathamus discolor | 0.75 |
| HU631 | Spotted Gum - Grey Ironbark open forest on the foothills of the Central Coast, Sydney Basin | Turquoise Parrot | Neophema pulchella | 0.55 |
| HU631 | Spotted Gum - Grey Ironbark open forest on the foothills of the Central Coast, Sydney Basin | Yellow-bellied Glider | Petaurus australis | 0.43 |
| HU631 | Spotted Gum - Grey Ironbark open forest on the foothills of the Central Coast, Sydney Basin | Yellow-bellied Sheath-tail-bat | Saccolaimus flaviventris | 0.45 |
| | | | Average | 0.56 |
| HU633 | Swamp Mahogany swamp forest on coastal lowlands of the North Coast and northern Sydney Basin | Barking Owl | Ninox connivens | 0.33 |
| HU633 | Swamp Mahogany swamp forest on coastal lowlands of the North Coast and northern Sydney Basin | Brown Treecreeper (eastern subspecies) | Climacteris picumnus victoriae | 0.5 |
| HU633 | Swamp Mahogany swamp forest on coastal lowlands of the North Coast and northern Sydney Basin | Bush Stone-curlew | Burhinus grallarius | 0.4 |
| HU633 | Swamp Mahogany swamp forest on coastal lowlands of the North Coast and northern Sydney Basin | Eastern Bentwing-bat | Miniopterus schreibersii oceanensis | 0.75 |
| HU633 | Swamp Mahogany swamp forest on coastal lowlands of the North Coast and northern Sydney Basin | Eastern False Pipistrelle | Falsistrellus tasmaniensis | 0.45 |
| HU633 | Swamp Mahogany swamp forest on coastal lowlands of the North Coast and northern Sydney Basin | Eastern Freetail-bat | Mormopterus norfolkensis | 0.45 |
| HU633 | Swamp Mahogany swamp forest on coastal lowlands of the North Coast and northern Sydney Basin | Eastern Pygmy-possum | Cercartetus nanus | 0.5 |
| HU633 | Swamp Mahogany swamp forest on coastal lowlands of the North Coast and northern Sydney Basin | Glossy Black-cockatoo | Calyptorhynchus lathami | 0.55 |
| HU633 | Swamp Mahogany swamp forest on coastal lowlands of the North Coast and northern Sydney Basin | Golden-tipped Bat | Kerivoula papuensis | 0.4 |
| HU633 | Swamp Mahogany swamp forest on coastal lowlands of the North Coast and northern Sydney Basin | Greater Broad-nosed Bat | Scoteanax rueppellii | 0.45 |
| HU633 | Swamp Mahogany swamp forest on coastal lowlands of the North Coast and northern Sydney Basin | Grey-headed Flying-fox | Pteropus poliocephalus | 0.93 |

| Veg Type | Veg Type Name | Common Name | Scientific Name | Tg Value |
|----------|--|-------------------------------|--|-------------|
| HU633 | Swamp Mahogany swamp forest on coastal lowlands of the North Coast and northern Sydney Basin | Koala | Phascolarctos cinereus | 0.83 |
| HU633 | Swamp Mahogany swamp forest on coastal lowlands of the North Coast and northern Sydney Basin | Large-footed Myotis | Myotis macropus (formally Myotis adversus) | 0.4 |
| HU633 | Swamp Mahogany swamp forest on coastal lowlands of the North Coast and northern Sydney Basin | Little Bentwing-bat | Miniopterus australis | 0.75 |
| HU633 | Swamp Mahogany swamp forest on coastal lowlands of the North Coast and northern Sydney Basin | Little Lorikeet | Glossopsitta pusilla | 0.58 |
| HU633 | Swamp Mahogany swamp forest on coastal lowlands of the North Coast and northern Sydney Basin | Long-nosed Potoroo | Potorous tridactylus | 0.75 |
| HU633 | Swamp Mahogany swamp forest on coastal lowlands of the North Coast and northern Sydney Basin | Regent Honeyeater | Xanthomyza phrygia | 0.75 |
| HU633 | Swamp Mahogany swamp forest on coastal lowlands of the North Coast and northern Sydney Basin | Rose-crowned Fruit-dove | Ptilinopus regina | 0.75 |
| HU633 | Swamp Mahogany swamp forest on coastal lowlands of the North Coast and northern Sydney Basin | Sooty Owl | Tyto tenebricosa | 0.33 |
| HU633 | Swamp Mahogany swamp forest on coastal lowlands of the North Coast and northern Sydney Basin | Spotted-tailed Quoll | Dasyurus maculatus | 0.35 |
| HU633 | Swamp Mahogany swamp forest on coastal lowlands of the North Coast and northern Sydney Basin | Squirrel Glider | Petaurus norfolcensis | 0.45 |
| HU633 | Swamp Mahogany swamp forest on coastal lowlands of the North Coast and northern Sydney Basin | Stephens' Banded Snake | Hoplocephalus stephensii | 0.3 |
| HU633 | Swamp Mahogany swamp forest on coastal lowlands of the North Coast and northern Sydney Basin | Superb Fruit-dove | Ptilinopus superbus | 0.75 |
| HU633 | Swamp Mahogany swamp forest on coastal lowlands of the North Coast and northern Sydney Basin | Swift Parrot | Lathamus discolor | 0.75 |
| HU633 | Swamp Mahogany swamp forest on coastal lowlands of the North Coast and northern Sydney Basin | Yellow-bellied Glider | Petaurus australis | 0.43 |
| HU633 | Swamp Mahogany swamp forest on coastal lowlands of the North Coast and northern Sydney Basin | Yellow-bellied Sheathtail-bat | Saccolaimus flaviventris | 0.45 |
| | | | Average | 0.55 |

Appendix 3: Flora Species List

Note:

1. Families are group under the headings Pteridophytes, Gymnosperms, Dicotyledons, Monocotyledons and Bryophytes
2. An ** before species indicates exotic species, # indicates non-local native
3. A sample flora assemblage obtained from a short term survey, such as the present one, cannot be considered comprehensive, but rather indicative of the actual flora assemblage.
4. Not all species can be accurately identified in a „snapshot“ survey due to seasonal absence of flowering or fruiting material.

| Family | Species | Common name | 33 | 34 | 35 | 36 | 37 | 38 | 39 | 40 | 41 | 42 | 43 | 44 | Meander |
|-------------------------|--|---------------------------------|----|----|----|----|----|----|----|----|----|----|----|----|---------|
| 1. Pteridophytes | | | | | | | | | | | | | | | |
| Adiantaceae | <i>Adiantum aethiopicum</i> | Common Maidenhair Fern | | | | | | | | | | | | | |
| Blechnaceae | <i>Doodia aspera</i> | Prickly Rasp Fern | | | | | | | | | | | | | |
| Dennstaedtiaceae | <i>Hypolepis muelleri</i> | Harsh Ground Fern | | | | | | | | X | | | | | |
| | <i>Pteridium esculentum</i> | Bracken | | | X | | X | | | | | | | | X |
| Gleicheniaceae | <i>Gleichenia dicarpa</i> | Pouched Coral Fern, Tangle Fern | | | | | | | | | | | | | X |
| Lindsaeaceae | <i>Lindsaea linearis</i> | Screw Fern | | | X | | | | | | | | | | X |
| Sinopteridaceae | <i>Cheilanthes sieberi</i> subsp. <i>sieberi</i> | Rock Fern | X | | | | | | | | X | | | | |
| 2. Gymnosperms | | | | | | | | | | | | | | | |
| Zamiaceae | <i>Macrozamia communis</i> | Burrawang | | | | | | | | | | | | | |
| 3. Dicotyledons | | | | | | | | | | | | | | | |
| Acanthaceae | <i>Brunoniella australis</i> | Blue Trumpet, Blue Yam | | | | | | X | | | | | | | |
| | <i>Brunoniella pumilio</i> | Dwarf Blue Trumpet | X | | X | | | | | | | | | | |
| | <i>Pseuderanthemum variabile</i> | Pastel Flower | | | | | | | | | | | | | |
| Apiaceae | <i>Centella asiatica</i> | Pennywort | | | | | | | | | X | | | | |
| | * <i>Hydrocotyle bonariensis</i> | Beach Pennywort | | | | | | | | | | | | | |
| | <i>Hydrocotyle peduncularis</i> | Pennywort | | X | | | | | | | | | | | X |
| | <i>Hydrocotyle tripartita</i> | Pennywort | | | | | | | | | | | | | |
| Apiaceae | <i>Trachymene incisa</i> | | | | | | | | | | | | | | |
| Apocynaceae | <i>Marsdenia rostrata</i> | Common Milkvine | | | | | X | | | | | | | | |
| | <i>Parsonia straminea</i> | Common Silkpod, Monkey Rope | X | | X | | | | | X | X | | | | X |
| Araliaceae | <i>Polyscias</i> | Elderberry | | | | | | | | | | | | | |

| Family | Species | Common name | 33 | 34 | 35 | 36 | 37 | 38 | 39 | 40 | 41 | 42 | 43 | 44 | Meander |
|-----------------|--|------------------------------------|----|----|----|----|----|----|----|----|----|----|----|----|---------|
| | <i>sambucifolia</i> | Panax | | | | | | | | | | | | | |
| Asteraceae | * <i>Ageratina adenophora</i> | Crofton Weed | | | | | | | | | | | | X | |
| | * <i>Bidens pilosa</i> | Farmer's Friend, Cobblers Pegs | | | | | X | | | | | X | | | |
| | <i>Brachyscome linearifolia</i> | | X | | | | | | | | | | | | |
| | * <i>Conyza sumatrensis</i> | Tall Fleabane | | | | | | | | | | | | | |
| | <i>Epaltes australis</i> | Spreading Nut-heads | | | | | | | | | | | | | |
| | <i>Euchiton</i> sp. | Cudweed | | | | | | | | | | | | | |
| | * <i>Gamochaeta spicata</i> | Purple Cudweed | | X | | X | | | | | | | | X | |
| | * <i>Hypochaeris radicata</i> | Catsear, False Dandelion | | X | | | | X | | | | X | X | | |
| | <i>Lagenophera stipitata</i> | Blue Bottle-daisy | X | | | | | | | | | | | | |
| | <i>Ozothamnus diosmifolius</i> | White Dogwood | | | | | | | | | | | | | |
| | <i>Senecio linearifolius</i> | Fireweed Groundsel | | | | | | | | | | | | | |
| | * <i>Senecio madagascariensis</i> | Fireweed, Madagascar Ragwort | | X | | | X | | | | | | | X | |
| | * <i>Sonchus asper</i> | Prickly Sow-thistle | | X | | | | | | | | | | | |
| | <i>Vernonia cinerea</i> | | X | | | | | | | | X | | | | |
| Bignoniaceae | <i>Pandorea pandorana</i> | Wonga Vine | | | | | | | | | | | | | |
| Campanulaceae | <i>Wahlenbergia gracilis</i> | Sprawling Bluebell | | | | | | | | | | | | | |
| | <i>Wahlenbergia</i> sp. (unidentified) | Australian Bluebell | | | | | | | | | | | | | |
| Caprifoliaceae | * <i>Lonicera japonica</i> | Japanese Honeysuckle | | | | | | | | | | | | | |
| Caryophyllaceae | <i>Cerastium glomeratum</i> | Mouse-ear Chickweed | | X | | | | | | | | | | | |
| Casuarinaceae | <i>Allocasuarina littoralis</i> | Black She-Oak | | | | X | X | X | X | X | | X | | | X |
| | <i>Allocasuarina torulosa</i> | Forest She-oak | X | | X | | | | | | | | | | |
| Celastraceae | <i>Maytenus silvestris</i> | | | | | | | | | | | | | | |
| Clusiaceae | <i>Hypericum gramineum</i> | Small St Johns-wort | | | | | | | | | | | | | |
| Convolvulaceae | <i>Convolvulus erubescens</i> | Native Bindweed, Blushing Bindweed | | | | | | | | | | | | | |
| | <i>Dichondra repens</i> | Kidney-weed, Mercury Bay Weed | | | | | | | | | | | | | |
| Dilleniaceae | <i>Hibbertia aspera</i> | Rough Guinea-flower | | | X | | | X | X | X | | X | | | X |
| | <i>Hibbertia diffusa</i> | Guinea-flower | | | | | | | | | | | | | |
| | <i>Hibbertia empetrifolia</i> | Trailing Guinea-flower | | | | | | | | | | | | | |
| | <i>Hibbertia scandens</i> | Twining Guinea-flower | | | | | | | | | X | | | | |
| | <i>Hibbertia serpyllifolia</i> | | | | | | | | | | | | | | |

| Family | Species | Common name | 33 | 34 | 35 | 36 | 37 | 38 | 39 | 40 | 41 | 42 | 43 | 44 | Meander |
|------------------------------|--|-----------------------------------|----|----|----|----|----|----|----|----|----|----|----|----|---------|
| Droseraceae | <i>Drosera binata</i> | Forked Sundew | X | | | | | | | | | | | | |
| | <i>Drosera peltata</i> | Pale Sundew | | | | | | | | X | X | | | | |
| | <i>Drosera pygmaea</i> | Pygmy Sundew | | | | | | | | | | | | | |
| | <i>Drosera spatulata</i> | Common Sundew | | | | | | | | | | | | | |
| Ericaceae - Styphelioideae | <i>Epacris pulchella</i> | | | | X | X | | | X | | X | | | X | |
| | <i>Leucopogon juniperinus</i> | Long-flowered Beard-heath | X | | | | | | | | | | | | |
| | <i>Lissanthe strigosa</i> | Peach Heath | | | | X | | | | | | | | | |
| | <i>Monotoca scoparia</i> | Prickly Broom-heath | | | | | | | | | | | | | |
| Euphorbiaceae | <i>Breynia oblongifolia</i> | Coffee Bush | | | | | | | | | | | | | |
| | <i>Glochidion ferdinandi</i> | Cheese Tree | | | | | | | | | | | | X | |
| | <i>Phyllanthus hirtellus</i> | Thyme Spurge | X | | X | | | X | X | X | X | X | X | | |
| | <i>Poranthera microphylla</i> | Small Poranthera | | | | | | | | | | | | | |
| Fabaceae Caesalpinioideae | * <i>Senna pendula</i> var. <i>glabrata</i> | Senna | | | | | | | | | | X | | | |
| Fabaceae Faboideae | <i>Bossiaea obcordata</i> | Spiny Bossiaea | | | | | X | | | | | | | | |
| | <i>Daviesia squarrosa</i> | | | | | X | | X | | | | | | | |
| | <i>Daviesia ulicifolia</i> | Gorse Bitter-pea | | | | | | | | | | | | | |
| | <i>Desmodium rhytidophyllum</i> | Tick-trefoil | | | | | X | | | | | | | | |
| | <i>Desmodium varians</i> | Slender Tick-trefoil | | | | | | | | | | | | | |
| | <i>Dillwynia retorta</i> | Eggs-and-bacon Pea, Parrot Pea | | | | | X | X | | | | | | | |
| | <i>Glycine clandestina</i> | Twining Glycine | | | | | | | | | X | | | | |
| | <i>Glycine microphylla</i> | | X | | | | X | | | | | | | | |
| | <i>Glycine tabacina</i> | Variable Glycine | | | | | | | | | | | | | |
| | <i>Gompholobium grandiflorum</i> | Wedge-pea | | | | | X | | | | | | | | |
| | <i>Hardenbergia violacea</i> | False Sarsaparilla | | | | X | X | X | | | X | | X | | |
| | * <i>Medicago</i> sp. | Medic | | X | | | | | | | | | X | | |
| | <i>Mirbelia rubiifolia</i> | | | | | | | X | X | | | | | | |
| | <i>Podolobium scandens</i> | Netted Shaggy Pea | | X | | X | | X | X | | X | | X | | |
| | <i>Pultenaea paleacea</i> | | | | | X | | | | | | | | | |
| | <i>Pultenaea retusa</i> | | | | | | | | | | | | | | |
| | <i>Pultenaea villosa</i> | | | | | X | | X | | | X | | | | |
| | <i>Sphaerolobium vimineum</i> | Leafless Globe-pea | | | | | | | | | | | | | |
| | * <i>Trifolium repens</i> | White Clover | | X | | | | | | | | | X | | |
| Fabaceae Mimosoideae | <i>Acacia brownii</i> | | | | | | | | | | | | | | |
| | <i>Acacia irrorata</i> subsp. <i>irrorata</i> | Green Wattle | | | | | | | | | | | | | |
| | <i>Acacia longifolia</i> | Sydney Golden | | | X | | | | | | | | | | |

| Family | Species | Common name | 33 | 34 | 35 | 36 | 37 | 38 | 39 | 40 | 41 | 42 | 43 | 44 | Meander |
|--------------|---|-------------------------------|----|----|----|----|----|----|----|----|----|----|----|----|---------|
| | | Wattle | | | | | | | | | | | | | |
| | <i>Acacia</i> sp. | | | | | | X | X | | | | | | | |
| | <i>Acacia stricta</i> | Hop Wattle | | | | | X | | | | | | | | |
| Geraniaceae | <i>Geranium homeanum</i> | Native Geranium | | | | | | | | | | | | | |
| Goodeniaceae | <i>Goodenia bellidifolia</i> | | | | | | | | | | | | | | |
| | <i>Goodenia hederacea</i> | Ivy Goodenia, Forest Goodenia | | | | | | X | | | | | | | |
| | <i>Goodenia heterophylla</i> | | | | | X | | | | | | | | | |
| | <i>Goodenia ovata</i> | | | | | | | | | | | | | | |
| | <i>Goodenia paniculata</i> | | | | | | | | | | | | | | |
| | <i>Scaevola ramosissima</i> | Purple Fan-flower | | | | | | | | | | | | | |
| Haloragaceae | <i>Gonocarpus micranthus</i> subsp. <i>micranthus</i> | | | | | | | | | | | | | | |
| | <i>Gonocarpus teucroides</i> | Raspwort | X | X | X | X | | X | X | X | X | X | X | X | |
| | <i>Haloragis heterophylla</i> | Raspwort | | | | | | | | | | | | | |
| Lamiaceae | <i>Plectranthus parviflorus</i> | Cockspur Flower | | | | | | | | | | | | | |
| Lauraceae | <i>Cassytha glabella</i> | Devil's Twine, Dodder-laurel | | | X | | | | | X | | X | | | |
| Lobeliaceae | <i>Pratia purpurascens</i> | Whiteroot | X | X | X | | | | | X | X | X | | X | |
| Loganiaceae | <i>Mitrasacme polymorpha</i> | Mitre Weed | | | | X | | | | | | | | | |
| Malvaceae | * <i>Sida rhombifolia</i> | Paddy's Lucerne | | | | | | | | | | | | | |
| Myrsinaceae | <i>Myrsine variabilis</i> | Muttonwood | | | | | | | | | | | | | |
| Myrtaceae | <i>Acmena smithii</i> | Lilly-pilly | | | | | | | | | | | | | |
| | <i>Angophora costata</i> | Smooth-barked Apple | | X | X | X | X | X | | X | | X | X | X | |
| | <i>Angophora floribunda</i> | Rough-barked Apple | | | | | | | | | | | | | |
| | <i>Backhousia myrtifolia</i> | Grey Myrtle, Ironwood | | | | | | | | | | | | | |
| | <i>Callistemon salignus</i> | White Bottlebrush, Pink-tips | | | | | | | | | | | | | |
| | # <i>Callistemon viminalis</i> | Weeping Bottlebrush | | X | | | | | | | | | | | |
| | <i>Corymbia gummifera</i> | Red Bloodwood | | | X | | X | X | | | | X | | X | |
| | <i>Corymbia maculata</i> | Spotted Gum | X | | | | | | X | | X | | X | | |
| | <i>Eucalyptus amplifolia</i> | Cabbage Gum | | | | | | | | | | | | | |
| | <i>Eucalyptus capitellata</i> | Brown Stringybark | | X | X | X | | | X | X | | X | X | X | |
| | <i>Eucalyptus crebra</i> | Narrow-leaved Ironbark | | | | | | | | | | | | | |
| | <i>Eucalyptus eugenioides</i> | Thin-leaved Stringybark | X | | | | | | X | | | | | | |
| | <i>Eucalyptus fibrosa</i> | Broad-leaved Red Ironbark | X | | | X | | X | X | | X | | | | |

| Family | Species | Common name | 33 | 34 | 35 | 36 | 37 | 38 | 39 | 40 | 41 | 42 | 43 | 44 | Meander |
|----------------|---|-------------------------------------|----|----|----|----|----|----|----|----|----|----|----|----|---------|
| | <i>Eucalyptus globoidea</i> | White Stringybark | X | | | X | | | | | X | | | | |
| | <i>Eucalyptus longifolia</i> | Woollybutt | | | | | | | | | | | | | |
| | <i>Eucalyptus paniculata</i> | Grey Ironbark | X | | | | | | | | | | | | |
| | <i>Eucalyptus parramattensis</i> subsp. <i>parramattensis</i> | Parramatta Red Gum | | | | | | | | | | | | | |
| | <i>Eucalyptus pilularis</i> | Blackbutt | | | | | X | | | | | X | | | |
| | <i>Eucalyptus punctata</i> | Grey Gum | | | | | | | | | | | | | |
| | <i>Eucalyptus racemosa</i> | Snappy Gum, Scribbly Gum | | | | | | | | | | | | | X |
| | <i>Eucalyptus resinifera</i> subsp. <i>resinifera</i> | Red Mahogany | | | | | | | | | | | | | |
| | <i>Eucalyptus robusta</i> | Swamp Mahogany | | | | | | | | | | | | X | |
| | <i>Eucalyptus saligna</i> | Sydney Blue Gum | | | | | | | | | | | | | |
| | <i>Eucalyptus tereticornis</i> | Forest Red Gum | | | | | | | | | | | | | |
| | <i>Eucalyptus umbra</i> | Broad-leaved White Mahogany | | | | | | | | | | | | | |
| | <i>Kunzea ambigua</i> | Tick-bush | | | | | | | | | | | | | |
| | <i>Leptospermum juniperinum</i> | Prickly Tea-tree | | | | | | | | | | | | X | |
| | <i>Leptospermum polygalifolium</i> subsp. <i>polygalifolium</i> | Yellow Tea-tree | | | X | | X | | | X | | | | X | |
| | <i>Leptospermum trinervium</i> | Paperbark Tea-tree | | | | | | | | | | | | X | |
| | <i>Melaleuca biconvexa</i> | | | | | | | | | | | | | | |
| | <i>Melaleuca decora</i> | White Cloud Tree | | | | | | | | | | | | | |
| | <i>Melaleuca ericifolia</i> | Swamp Paperbark | | | | | | | | | | | | | |
| | <i>Melaleuca linariifolia</i> | Flax-leaved Paperbark | | | | | | | | | | | | | |
| | <i>Melaleuca nodosa</i> | Ball Honey-myrtle | X | | | | | | X | X | X | X | | X | |
| | <i>Melaleuca sieberi</i> | | | | | | | | | X | | X | | X | |
| | <i>Melaleuca styphelioides</i> | Prickly Paperbark | | | | | | | | | | | | | |
| | <i>Melaleuca thymifolia</i> | Thyme Honey-myrtle | | | | | | | | | | | | | |
| | <i>Syncarpia glomulifera</i> | Turpentine | | | | | | | | | | | | | |
| Oleaceae | * <i>Ligustrum sinense</i> | Small-Leaved Privet, Chinese Privet | | | | | | | | | | X | | | |
| | <i>Notelaea longifolia</i> | Mock-olive | | | | | | | | | | | | | |
| Oxalidaceae | <i>Oxalis perennans</i> | Oxalis | X | | | | | | | | | | | | |
| Passifloraceae | * <i>Passiflora edulis</i> | Passionfruit | | | | | X | | | | | | | | |
| Pittosporaceae | <i>Billardiera scandens</i> | Appleberry, Dumplings, | X | | X | | X | X | X | | | X | | | |

| Family | Species | Common name | 33 | 34 | 35 | 36 | 37 | 38 | 39 | 40 | 41 | 42 | 43 | 44 | Meander |
|----------------|--|----------------------------------|----|----|----|----|----|----|----|----|----|----|----|----|---------|
| | | Snotberry | | | | | | | | | | | | | |
| | <i>Bursaria spinosa</i> | Australian Boxthorn | X | | | | | | | | | | | | |
| | <i>Pittosporum revolutum</i> | Yellow Pittosporum | | | | | | | | | | | | | |
| | <i>Pittosporum undulatum</i> | Sweet Pittosporum | X | | X | | | | | X | | X | | | |
| Plantaginaceae | * <i>Plantago lanceolata</i> | Plantain, Ribwort | | X | | | | | | | | | X | | |
| Polygalaceae | <i>Comesperma ericinum</i> | Heath Milkwort | | | | X | | | | | | | | | |
| Polygonaceae | <i>Persicaria praetermissa</i> | | | | | | | | | | | | | | |
| | <i>Persicaria strigosa</i> | Bristly Knotweed | | | | | | | | | | | | | |
| | <i>Rumex brownii</i> | Slender Dock | | | | | | | | | | | | | |
| Primulaceae | * <i>Anagallis arvensis</i> | Pimpernel | | | | | | | | | | | | | |
| Proteaceae | <i>Banksia oblongifolia</i> | | | | | | | | | | | | | | |
| | <i>Banksia serrata</i> | Saw Banksia, Old Man Banksia | | | | | X | | | | | | | | X |
| | <i>Banksia marginata</i> | Silver Banksia | | | | | | | | | | | | X | |
| | <i>Banksia spinulosa</i> var. <i>collina</i> | Hill Banksia | | | X | | | X | | | | | | | |
| | <i>Hakea laevipes</i> subsp. <i>laevipes</i> | | | | | | | | | | | | | | |
| Proteaceae | * <i>Hakea salicifolia</i> | Willow Hakea | | | | | | | | | | | | | |
| | <i>Lambertia formosa</i> | Mountain Devil, Honey-flower | | | X | | | | | | | | | X | |
| | <i>Lomatia silaifolia</i> | Native Parsley, Crinklebush | | | | | X | | | | | | | | |
| | <i>Persoonia levis</i> | Broad-leaved Geebung | | | | | | | | | | | | | |
| | <i>Persoonia linearis</i> | Narrow-leaf Geebung | | | | | X | | | | | | | X | |
| Ranunculaceae | <i>Clematis aristata</i> | Traveller's Joy, Old Man's Beard | | | | | | | | | | | | | |
| | <i>Clematis glycinoides</i> | Headache Vine, Traveller's Joy | | | | | | | | | | | | | |
| | <i>Ranunculus inundatus</i> | River Buttercup | | | | | | | | | | | | | |
| | <i>Ranunculus lappaceus</i> | Australian Buttercup | | | | | | | | | | | | | |
| | <i>Ranunculus plebeius</i> | Hairy Buttercup | | | | | | | | | | | | | |
| Rosaceae | * <i>Rubus fruticosus</i> (sp. agg) | Blackberry | | | | | | | | | | | | X | |
| Rubiaceae | <i>Galium propinquum</i> | | | | | | | | | | | | | | |
| | <i>Galium</i> sp. | | | | | | | | | | | | | | |
| | <i>Morinda jasminoides</i> | Morinda | | | | | | | | | | | | | |
| | <i>Opercularia diphylla</i> | Stinkweed | | | | | X | | | | | | | | |
| | <i>Opercularia varia</i> | Stinkweed | X | | | X | | X | X | | X | X | X | | |
| | <i>Pomax umbellata</i> | Pomax | | | | | | | | | X | | | | |

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|--------------------------|---------------------------------|----------------------------------|----|----|----|----|----|----|----|----|----|----|----|----|---------|
| Rutaceae | <i>Boronia polygalifolia</i> | | | | | | | | | | | | | | |
| | <i>Zieria smithii</i> | Sandfly Zieria, Stinkwood | | | | | | | | | | | | | |
| Sapindaceae | <i>Dodonaea triquetra</i> | Hopbush | | | | | | | | | | | | | |
| Scrophulariaceae | <i>Veronica plebeia</i> | Creeping Speedwell | | | | | | | | | | | | | |
| Solanaceae | * <i>Solanum mauritianum</i> | Tree Tobacco, Wild Tobacco | | | | | | | | | | | | | |
| | <i>Solanum prinophyllum</i> | Forest Nightshade | | | | | | | | | | | | | |
| Stylidiaceae | <i>Stylidium graminifolium</i> | Grass-leaf Triggerplant | | | | X | | | | | | | | | |
| Thymelaeaceae | <i>Pimelea linifolia</i> | Rice Flower | X | | | | X | | X | | X | | | | |
| Verbenaceae | * <i>Lantana camara</i> | Lantana | X | | | | X | X | | | X | X | | X | |
| | * <i>Verbena bonariensis</i> | Purpletop | | | | | | | | | | | | | |
| Violaceae | <i>Viola betonicifolia</i> | Showy Violet | X | | | | | | | | | | | | |
| Violaceae | <i>Viola hederacea</i> | Native Violet, Ivy-leaved Violet | | | | | | | | | | | | | |
| 4. Monocotyledons | | | | | | | | | | | | | | | |
| Anthericaceae | <i>Arthropodium milleflorum</i> | Vanilla Lily | | | | | | | | | | | | | |
| | <i>Caesia parviflora</i> | Pale Grass Lily | X | | | | | | | | | | | X | |
| | <i>Laxmannia gracilis</i> | Slender Wire Lily | X | | | X | | | | | X | | | | |
| | <i>Thysanotus sp.</i> | Fringe Lily | | | | | | | | | | | | X | |
| Arecaceae | * <i>Phoenix canariensis</i> | Canary Island Date | | | | | | | | | | X | | | |
| Asparagaceae | * <i>Asparagus aethiopicus</i> | Asparagus Fern | | | | | | | | | X | | | | |
| | * <i>Asparagus asparagoides</i> | Bridal Creeper | | | | | | | | | | X | | | |
| Colchicaceae | <i>Burchardia umbellata</i> | Milkmaids | | | X | X | | | | | | | X | | |
| Commelinaceae | <i>Commelina cyanea</i> | Blue Spiderwort | | | | | | | | | | | | | |
| Cyperaceae | <i>Baumea acuta</i> | | | | | | | | | | | | | | |
| | <i>Baumea articulata</i> | Jointed Twig-rush | | | | | | | | | | | | | |
| | <i>Baumea planifolia</i> | | | | | | | | | | | | | | |
| | <i>Baumea rubiginosa</i> | Soft Twig-rush | | | | | | | | | | | | | |
| | <i>Baumea sp.</i> | | | | | | | | | X | | | | | |
| | <i>Baumea teretifolia</i> | Wrinklenut Twig-rush | | | | | | | | | | | | | |
| | <i>Carex appressa</i> | Tall Sedge | | | | | | | | | | | | | |
| | <i>Carex gaudichaudiana</i> | Tufted Sedge | | | | | | | | | | | | | |
| | <i>Carex inversa</i> | Knob Sedge | | | | | | X | | | | X | X | | |
| | <i>Chorizandra cymbaria</i> | | | | | | | | | | | | | | |
| | <i>Cyathochaeta diandra</i> | | | | | | X | | | | | | | | |
| | <i>Cyperus exaltatus</i> | Giant Sedge, Tall Flat-sedge | | | | | | | | | | | | | |
| | <i>Cyperus</i> | | | X | | | | | | | | | | | |

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|---------------|---|--------------------------------------|----|----|----|----|----|----|----|----|----|----|----|----|---------|
| | <i>polystachyos</i> | | | | | | | | | | | | | | |
| | <i>Cyperus</i> sp. | | | | | | | | | | | | | | X |
| | <i>Eleocharis</i> sp. | Spike-rush | | | | | | | | | | | | | |
| | <i>Fimbristylis dichotoma</i> | | | | | | | | | | | | | | |
| | <i>Gahnia clarkei</i> | Saw-sedge | | | X | | | | | | X | X | | X | |
| | <i>Gahnia radula</i> | | | | | | | | | X | | | | | |
| | <i>Gahnia sieberiana</i> | Red-fruited Saw-sedge | | | | | | | | | | | | | |
| | <i>Isolepis sepulcralis</i> | | | | | | | | | | | | | | |
| | <i>Isolepis</i> sp. | Club-rush | | X | | | | | | | | | | | X |
| | <i>Lepidosperma gunnii</i> | | | | | | | | | | X | | | | |
| | <i>Lepidosperma laterale</i> | Variable Sword-sedge | X | | X | X | | X | X | | X | X | | X | |
| | <i>Lepidosperma</i> sp. | | | | | | | | | | | | | | |
| | <i>Ptilothrix deusta</i> | | | | X | X | | X | X | X | | X | X | | |
| | <i>Schoenus apogon</i> | Fluke Bog-rush, Common Bog-rush | | | | | | | | | | | | | |
| | <i>Schoenus brevifolius</i> | Zigzag Bog-rush | | | | | | | | | | | | | |
| | <i>Schoenus</i> sp. | | | | X | | | | | | | | | | |
| Dioscoreaceae | <i>Dioscorea transversa</i> | Native Yam | | | | | | | | | | | | | |
| Haemodoraceae | <i>Haemodorum planifolium</i> | Strap-leaf Bloodroot | | | | | | | | | | | | | |
| Hypoxidaceae | <i>Hypoxis hygrometrica</i> | Golden Star, Golden Weather-glass | | | | X | | | | | | | | | |
| Iridaceae | <i>Patersonia glabrata</i> | Native Iris, Leafy Purple-flag | | | X | | | | | | | | | | |
| | <i>Patersonia sericea</i> | Native Iris, Silky Purple-flag | | | X | X | | X | X | X | X | | | | |
| | * <i>Watsonia</i> sp. | | | | | | | | | | | | | | |
| Juncaceae | <i>Juncus continuus</i> | | | X | | | | | | | | | X | | |
| | <i>Juncus</i> sp. | Rush | | | | | | | | | | | | | |
| | <i>Juncus usitatus</i> | | | | | | | | | | | | | | |
| Lomandraceae | <i>Lomandra confertifolia</i> | | | | | | | | | | | | | | |
| | <i>Lomandra filiformis</i> subsp. <i>coriacea</i> | Wattle Mat-rush | | | | | | | | | | | | | |
| | <i>Lomandra filiformis</i> subsp. <i>filiformis</i> | Wattle Mat-rush | | | X | X | X | X | | | X | X | X | | |
| | <i>Lomandra glauca</i> | Pale Mat-rush | | | X | X | X | | X | X | X | X | | | |
| | <i>Lomandra longifolia</i> | Spiny-headed Mat-rush | X | | | | | X | | X | | X | | X | |
| | <i>Lomandra multiflora</i> | Many-flowered Mat-rush | X | | X | X | | X | X | X | X | | | | |
| | <i>Lomandra obliqua</i> | | | | X | X | | X | | | | | X | | |
| Orchidaceae | <i>Acianthus fornicatus</i> | Gnat Orchid | X | | | | | | | | | | | | |
| | <i>Caladenia catenata</i> | Pink Fingers | X | | X | | | | X | X | X | | | | |

| Family | Species | Common name | 33 | 34 | 35 | 36 | 37 | 38 | 39 | 40 | 41 | 42 | 43 | 44 | Meander |
|--------------|---|-------------------------------------|----|----|----|----|----|----|----|----|----|----|----|----|---------|
| | <i>Caladenia</i> sp. | | | | X | | | | | | | | | | |
| | <i>Calochilus campestris</i> | Copper Beard-orchid | | | | | | | X | | | | | | |
| | <i>Calochilus robertsonii</i> | Purplish Beard-orchid | | | | | | X | | X | X | | X | | |
| | <i>Chiloglottis</i> sp. | | X | | | | | | | | | | | | |
| | <i>Cryptostylis erecta</i> | Tartan Tongue Orchid | | | | | | | | X | | | | X | |
| | <i>Cryptostylis subulata</i> | Large Tongue-orchid, Cow Orchid | | | | X | | X | | | | | | X | |
| | <i>Diuris aurea</i> | Golden Doubletails | | | | | | | | | | | | | |
| | <i>Lyperanthus suaveolens</i> | Brown Beaks | | | | | | | | | | | | | |
| | <i>Microtis</i> sp. | | | | | | | | | | | | X | | |
| | <i>Pterostylis baptistii</i> | King Greenhood | | | | | | | | | | | | | |
| | <i>Pterostylis erecta</i> | Greenhood | | | | | | | | | | | | | |
| | <i>Pterostylis longifolia</i> | Greenhood Orchid | | | | | | | | | | | | | |
| | <i>Pterostylis nutans</i> | Nodding Greenhood | X | | | | | | | | | | | | |
| | <i>Thelymitra ixioides</i> | Spotted Sun Orchid | | | | | | | | | | | | | |
| | <i>Thelymitra purpurata</i> | Wallum Sun Orchid | | | | | | | | | | | | | |
| | <i>Thelymitra</i> sp. | Sun Orchid | | | | | | | | | | | X | | |
| Philesiaceae | <i>Eustrephus latifolius</i> | Wombat Berry | | | | | | | | | | | | | |
| | <i>Geitonoplesium cymosum</i> | Scrambling Lily | | | | | | | | | | | | | |
| Philydraceae | <i>Philydrum lanuginosum</i> | Woolly Waterlily, Frogmouth | | | | | | | | | | | | | |
| Phormiaceae | <i>Dianella caerulea</i> | Blue Flax-lily | | | X | | | | | | | | | | |
| | <i>Dianella caerulea</i> var. <i>producta</i> | Blue Flax-lily | X | X | | | X | X | X | X | X | X | X | X | |
| | <i>Dianella longifolia</i> | Smooth Flax-lily | | | | | | | | | | | | | |
| Phormiaceae | <i>Dianella revoluta</i> | Blue Flax-lily, Spreading Flax-lily | X | | X | X | | X | | | | | | | |
| Poaceae | * <i>Andropogon virginicus</i> | Whisky Grass, Broomsedge | | X | | X | | | | | | X | X | | |
| | <i>Aristida ramosa</i> | Purple Wiregrass | | | | | | | | | | X | | | |
| | <i>Aristida vagans</i> | Threeawn Speargrass | | | | | X | X | X | X | X | X | | | |
| | <i>Aristida warburgii</i> | Wiregrass | | | | | | | | | X | | X | | |
| | <i>Austrodanthonia racemosa</i> | Wallaby Grass | | | | X | | X | | | | | | | |
| | <i>Austrostipa pubescens</i> | | | | | | | | | | | | | X | |
| | <i>Austrostipa</i> sp. | Speargrass | X | | X | | X | | X | | | | | | |
| | * <i>Avena</i> sp. | Wild Oats | | | | | | | | | | | | | |
| | * <i>Axonopus fissifolius</i> | Narrow-leaved Carpet Grass | | X | | | | | | | | | X | | |
| | * <i>Briza maxima</i> | Quaking Grass | | | | | | | | | | | X | | |

| Family | | Species | Common name | 33 | 34 | 35 | 36 | 37 | 38 | 39 | 40 | 41 | 42 | 43 | 44 | Meander |
|--------|---|---|----------------------------------|----|----|----|----|----|----|----|----|----|----|----|----|---------|
| | * | <i>Cortaderia selloana</i> | Pampas Grass | | | | | | | | | | | | | |
| | | <i>Cymbopogon refractus</i> | Barbed Wire Grass | | | | | | | | | | | | | |
| | * | <i>Cynodon dactylon</i> | Couch, Bermuda Grass | | | | | | | | | | | | | |
| | | <i>Dichelachne micrantha</i> | Shorthair Plumegrass | X | | | | | X | | | | | | | |
| | | <i>Digitaria parviflora</i> | Smallflower Finger Grass | X | | | | X | | | | | X | | | |
| | | <i>Echinopogon caespitosus</i> | Tufted Hedgehog Grass | | | | | | | | X | X | | | | |
| | | <i>Echinopogon ovatus</i> | Forest Hedgehog Grass | | | | | | | | | | | | X | |
| | | <i>Entolasia marginata</i> | Bordered Panic | | | | | | | | | | | | X | |
| | | <i>Entolasia stricta</i> | Wiry Panic | X | X | X | X | X | X | X | X | X | X | X | | |
| | | <i>Eragrostis brownii</i> | Brown's Lovegrass | X | | | X | | | | | X | X | X | | |
| | * | <i>Eragrostis curvula</i> | African Lovegrass | | | | | | | | | | | | | |
| | | <i>Eragrostis leptostachya</i> | Paddock Lovegrass | X | | | | | | | | | | | | |
| | | <i>Eragrostis sp.</i> | Love Grass | | | | | | | | | | | | | |
| | | <i>Hemarthria uncinata</i> | Mat Grass | | | | | | | | | | | | | |
| | | <i>Imperata cylindrica</i> | Blady Grass | X | | X | | X | | X | | | X | X | X | |
| | | <i>Isachne globosa</i> | Swamp Millet | | | | | | | | | | | | | |
| | | <i>Ischaemum australe var. australe</i> | | | | | | | | | | | | | X | |
| | | <i>Joycea pallida</i> | Red-anther Wallaby Grass | X | | X | X | | X | | | | X | X | | |
| | * | <i>Lolium perenne</i> | Perennial Ryegrass | | X | | | | | | | | | | | |
| | | <i>Microlaena stipoides</i> | Meadow Rice-grass, Weeping Grass | | X | X | X | X | | | | | | | X | |
| | | <i>Oplismenus aemulus</i> | Broad-leaved Basket Grass | | | | | X | | | | | | | | |
| | | <i>Oplismenus imbecillis</i> | Narrow-leaved Basket Grass | | | | | | | | | | | | | |
| | | <i>Panicum obseptum</i> | White Water Panic | | | | | | | | | | | | | |
| | | <i>Panicum simile</i> | Two-colour Panic | | | | X | | X | | X | | | | | |
| | | <i>Paspalidium distans</i> | Spreading Panicgrass | | | | | | | X | | X | X | | | |
| | * | <i>Paspalum dilatatum</i> | Paspalum | | | | | | | | | | | | | |
| | | <i>Paspalum orbiculare</i> | Ditch Millet | | | | | | | | | | | | | |
| | * | <i>Paspalum urvillei</i> | Vasey Grass | | X | | | | | | | | | | | |
| | * | <i>Pennisetum clandestinum</i> | Kikuyu | | X | | | | | | | | | | | |
| | | <i>Poa affinis</i> | Poa Tussock | | | | | | | | | | | | | |

| Family | Species | Common name | 33 | 34 | 35 | 36 | 37 | 38 | 39 | 40 | 41 | 42 | 43 | 44 | Meander |
|----------------------|--------------------------------|----------------------------------|----|----|----|----|----|----|----|----|----|----|----|----|---------|
| | <i>Sacciolepis indica</i> | Indian Cupscale Grass | | | | | | | | | | | | X | |
| | * <i>Setaria parviflora</i> | Slender Pigeon Grass | | | | | | | | | | | | | |
| | * <i>Sporobolus africanus</i> | Parramatta Grass | | | | | | | | | | | X | | |
| | <i>Themeda australis</i> | Kangaroo Grass | X | X | X | X | X | X | X | X | X | X | X | X | |
| Restionaceae | <i>Empodisma minus</i> | Tanglefoot | | | | | | | | | | | | | |
| | <i>Leptocarpus tenax</i> | | | | | | | | | | | | | | |
| | <i>Lepyrodia scariosa</i> | Scale-rush | | | | | | | | X | | | | X | |
| Smilacaceae | <i>Smilax australis</i> | Lawyer Vine, Native Sarsaparilla | | | | | | | | | | | | | |
| | <i>Smilax glycyphylla</i> | Sweet Sarsaparilla | | | X | | | | | | | | | | |
| Xanthorrhoeaceae | <i>Xanthorrhoea fulva</i> | Swamp Grasstree | | | | | | | | | | | | | |
| | <i>Xanthorrhoea media</i> | Grass Tree | | | | | X | | X | X | | X | X | | |
| | <i>Xanthorrhoea resinifera</i> | Grass-tree | | | X | X | | X | | | | | | | |
| 5. Bryophytes | | | | | | | | | | | | | | | |
| Sphagnaceae | <i>Sphagnum cristatum</i> | Sphagnum Moss | | | | | | | | | | | | | |

Appendix 5: Transect/Plot Data

WARNERVALE TOWN CENTRE

Vegetation Zone: Blackbutt - Turpentine open forest of the foothills of the North Coast/Good

| PlotName | NPS | NOS | NMS | NGCG | NGCS | NGCO | EPC | NTH | OR | FL | Longitude | Latitude | Zone |
|----------|-----|------|------|------|------|------|-----|-----|----|----|-----------|----------|------|
| Plot 37 | 34 | 30 | 1 | 16 | 0 | 32 | 0 | 0 | 1 | 82 | 356861 | 6321410 | 56 |
| Plot 42 | 33 | 32.5 | 10.7 | 30 | 0 | 6 | 0 | 2 | 1 | 0 | 357069 | 6321177 | 56 |

Vegetation Zone: Smooth-barked Apple - Red Bloodwood open forest on coastal plains on the Central Coast, Sydney Basin/Poor

| PlotName | NPS | NOS | NMS | NGCG | NGCS | NGCO | EPC | NTH | OR | FL | Longitude | Latitude | Zone |
|----------|-----|------|-----|------|------|------|-----|-----|----|----|-----------|----------|------|
| Plot 34 | 15 | 10.5 | 0 | 4 | 0 | 2 | 82 | 1 | 1 | 1 | 356796 | 6320853 | 56 |
| Plot 43 | 25 | 29 | 0 | 10 | 0 | 6 | 44 | 0 | 1 | 0 | 357179 | 6321145 | 56 |

Vegetation Zone: Smooth-barked Apple - Red Bloodwood open forest on coastal plains on the Central Coast, Sydney Basin/Moderate

| PlotName | NPS | NOS | NMS | NGCG | NGCS | NGCO | EPC | NTH | OR | FL | Longitude | Latitude | Zone |
|----------|-----|------|-------|------|------|------|-----|-----|----|----|-----------|----------|------|
| Plot 36 | 38 | 21.5 | 10.5 | 2 | 2 | 58 | 0 | 1 | 1 | 2 | 357349 | 6321083 | 56 |
| Plot 40 | 33 | 24 | 12.25 | 6 | 0 | 50 | 0 | 0 | 1 | 20 | 356894 | 6320833 | 56 |

Vegetation Zone: Smooth-barked Apple - Red Bloodwood open forest on coastal plains on the Central Coast, Sydney Basin/Good

| PlotName | NPS | NOS | NMS | NGCG | NGCS | NGCO | EPC | NTH | OR | FL | Longitude | Latitude | Zone |
|----------|-----|------|-----|------|------|------|-----|-----|----|----|-----------|----------|------|
| Plot 35 | 43 | 15.5 | 12 | 20 | 4 | 56 | 0 | 0 | 1 | 40 | 356875 | 6321035 | 56 |
| Plot 38 | 39 | 29 | 9.5 | 44 | 0 | 20 | 0 | 0 | 1 | 39 | 357014 | 6321474 | 56 |

Vegetation Zone: Spotted Gum - Grey Ironbark open forest on the foothills of the Central Coast, Sydney Basin/Moderate

| PlotName | NPS | NOS | NMS | NGCG | NGCS | NGCO | EPC | NTH | OR | FL | Longitude | Latitude | Zone |
|----------|-----|------|-----|------|------|------|-----|-----|----|----|-----------|----------|------|
| Plot 41 | 38 | 19.5 | 10 | 36 | 0 | 8 | 0 | 0 | 1 | 0 | 357587 | 6321300 | 56 |

Vegetation Zone: Spotted Gum - Grey Ironbark open forest on the foothills of the Central Coast, Sydney Basin/Good

| PlotName | NPS | NOS | NMS | NGCG | NGCS | NGCO | EPC | NTH | OR | FL | Longitude | Latitude | Zone |
|----------|-----|------|-----|------|------|------|-----|-----|----|----|-----------|----------|------|
| Plot 33 | 46 | 24.5 | 23 | 40 | 0 | 24 | 0 | 0 | 1 | 16 | 356298 | 6321231 | 56 |
| Plot 39 | 31 | 30 | 12 | 74 | 2 | 8 | 0 | 0 | 1 | 6 | 356206 | 6320946 | 56 |

Vegetation Zone: Swamp Mahogany swamp forest on coastal lowlands of the North Coast and northern Sydney Basin /Good

| PlotName | NPS | NOS | NMS | NGCG | NGCS | NGCO | EPC | NTH | OR | FL | Longitude | Latitude | Zone |
|----------|-----|------|-----|------|------|------|-----|-----|-----|----|-----------|----------|------|
| Plot 43 | 41 | 16.5 | 30 | 6 | 6 | 70 | 30 | 0 | 0.5 | 9 | 356601 | 6320809 | 56 |

Appendix 6: Red Flag Variation

The Biodiversity Certification Assessment of the Warnervale Town Centre has been completed to the specifications of the Biodiversity Certification Assessment Methodology (DECCW 2011). Under the method biodiversity values are regarded as being improved or maintained (and biodiversity certification is conferred) if there is no direct impact on red flag areas. In the case of the WTC, however, a red flag area has been impacted (Figure 16), being:

- 0.1 ha of Swamp Mahogany swamp forest on coastal lowlands of the North Coast and northern Sydney Basin

The conferral of biodiversity certification for this area requires Director General approval, after consideration of criteria in Section 2.4 of the BCAM (DECCW 2011). The methodology states the Director General may, in certain circumstances, decide that the impacts of certification on the red flag area may be offset in accordance with the rules and requirements of the methodology.

The criteria to determine whether impacts on a red flag area may be offset (or the red flag „varied”) are provided in Section 2.4 of the BCAM. The following criteria need to be addressed:

- Feasibility of options to avoid impacts on red flag area(s) where biodiversity certification is conferred (DECCW 2011)
- Viability of the red flag area is low or not viable (the application for biodiversity certification must demonstrate to the satisfaction of the Director General that the viability of biodiversity values in the red flag area is low or not viable) (DECCW 2011)
- The contribution to regional biodiversity values of the red flag area is low (the application for biodiversity certification must demonstrate to the satisfaction of the Director General that the red flag area on land proposed for biodiversity certification makes a low contribution to regional biodiversity values). (DECCW 2011)

This appendix provides the information required for OEH to consider a red flag variation for the WTC BCAA. ELA believe that the red flag variation is justified based on the information provided below.



Figure 16: Red flag

SWAMP MAHOGANY SWAMP FOREST

An impact of 0.1ha has been identified on the Swamp Mahogany swamp forest on coastal lowlands of the North Coast and northern Sydney Basin vegetation type, which meets the definition of the Endangered Ecological Community (EEC) Swamp sclerophyll forest on coastal floodplains of the NSW North Coast, Sydney Basin and South East Corner bioregions.

Provided below are details associated with the red flag and information required to consider a red flag variation.

Avoiding and minimising impacts

Efforts have been made to avoid and minimise impacts on this small (0.1ha) red flagged vegetation polygon, however due to the location of the red flagged vegetation complete avoidance has been difficult to achieve.

The red flagged vegetation is located on the southern boundary of the WTC BCAA, within one of the drainage lines on site. Due to its location within the drainage line, and its low point in the catchment, the site has been identified as the location of a detention basin, which is required to ensure Water Sensitive Urban Design (WSUD) principles are met. There are no feasible alternatives to the placement of this detention basin.

Although a detention basin is the likely outcome for the area, the land containing the red flagged vegetation is proposed to be zoned Public Recreation (RE1) (Figure 17). The RE1 zoning may provide some level of protection for the EEC, with native vegetation and biodiversity potentially maintained to some degree if not removed by the detention basin. Future plans will identify if any avoidance can be incorporated into the detention basin.

Viability

The viability of the red flagged EEC was assessed against several of the factors listed in the methodology. Details to support the variation are provided below.

Current and future land uses and size and connectedness

The patch of EEC being impacted is very small (0.1ha), and represents the only EEC on site. While the vegetation is currently connected to the north, cleared land lies directly to the west, while Sparks Road lies directly to the south. To the east lies a mixture of cleared land and vegetated land, much in moderate and poor condition. The viability of the patch of EEC is therefore currently low due to its small size and current competing surrounding land use, and with on-going pressures the condition of this vegetation is likely to decline.

Residential (R1) zoning is proposed surrounding the EEC (and area of Public Recreation (RE1) zoning). The proposed Residential (R1) zoning (and therefore residential development) will further isolate the EEC vegetation, with cleared land now occurring to the west and east of the EEC, and the northern linkage likely to be lost. Sparks Road will remain to the south, isolating all vegetation within the Public Recreation area, including the 0.1ha of EEC. It is likely that the viability of the patch of EEC will continue to be low due to its small size and the proposed surrounding land use and development.

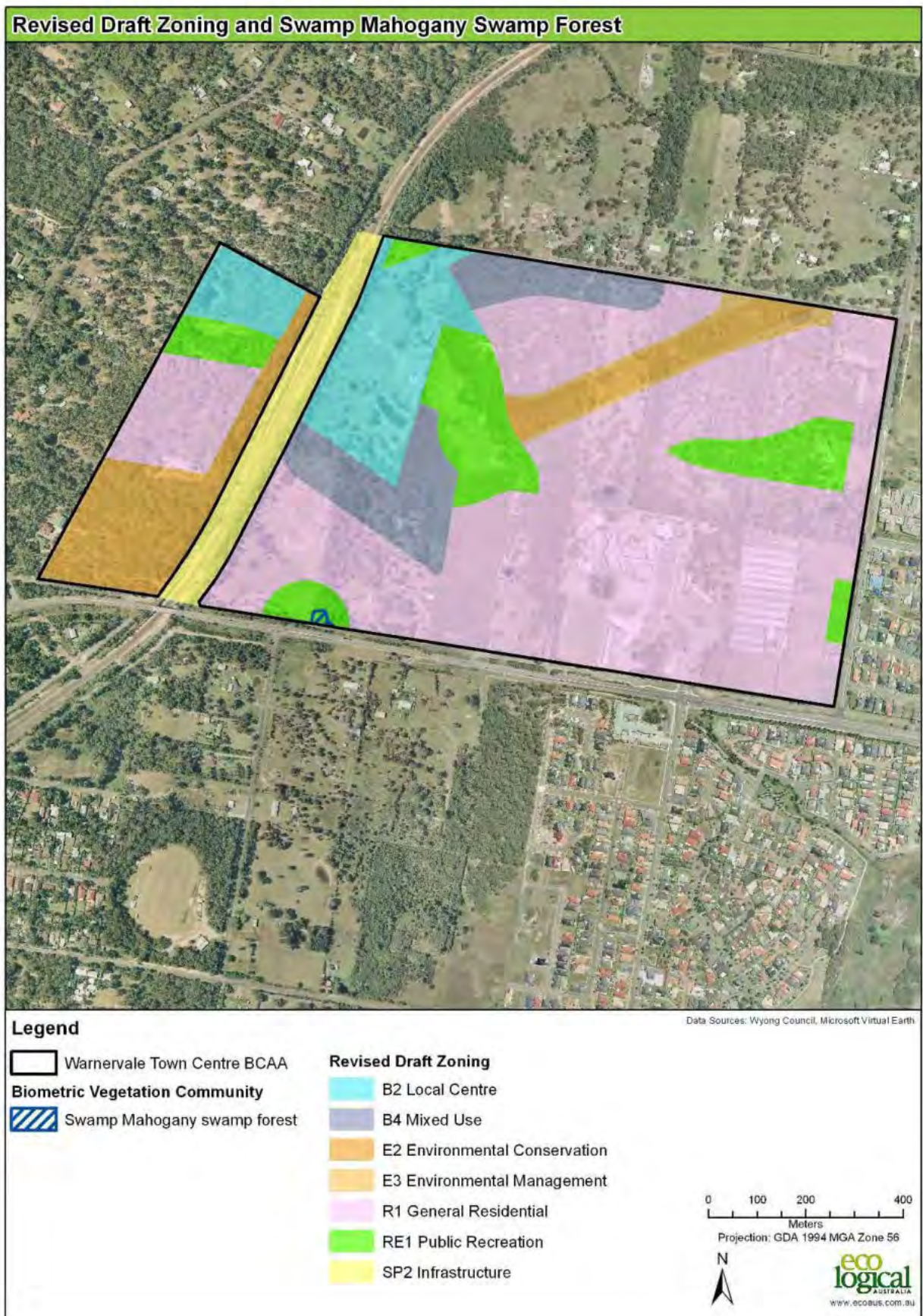


Figure 17: Revised draft zoning and Swamp Mahogany Swamp Forest

Contribution to regional biodiversity values

The contribution to regional biodiversity values of the 0.1ha of red flagged EEC was assessed for the red flagged vegetation, using regional vegetation datasets where available. Under the BCAM a „region“ is defined as:

- The CMA subregion where the red flag area is located- Wyong CMA subregion
- Adjoining CMA subregions, including the Yengo, Pittwater and Hunter CMA subregions (Figure 18).

During the assessment, where consistent data is not available for the „region“, alternate regions have been assessed as a surrogate, and have been identified in the relevant sections.

The use of regional vegetation datasets in this assessment, while the best data currently available, does have limitations, including:

1. The data in some cases is several years old, and therefore the extant mapping may require revision
2. The vegetation types mapped in the regional data sets differ to the revised Biometric Vegetation Types. From the vegetation descriptions in each report ELA ecologists have converted the vegetation mapping to the Biometric Vegetation Types, however this process is difficult and errors can be made in assigning the correct vegetation type
3. Most vegetation types only map patches greater than a minimum size (for example 0.5ha) and generally only map vegetation in reasonably good condition. It is highly likely that smaller patches of these vegetation types exist in the study area, however have not been included in this assessment as the patches are too small to map, or the condition is disturbed and therefore has not been mapped.

The contribution to regional biodiversity values includes an assessment of the relative abundance of the red flagged vegetation type, the percent remaining of the vegetation type and the percent native vegetation remaining in the region. Details to support the variation are provided below.

Relative abundance

The first measure for the contribution to regional biodiversity values criteria is a measure of relative abundance of the red flagged vegetation types in the „region“. As stated previously, and to provide a basis for measuring the impact on a regional basis, 0.1ha of the Swamp sclerophyll forest on coastal floodplains of the NSW North Coast, Sydney Basin and South East Corner bioregions EEC occurs on site (and is potentially impacted).

Analysis was conducted into the relative abundance of the red flagged vegetation type in several regions, at various scales. As data was not available over the entire „region“ as defined above, ELA have used vegetation mapping available at different scales. This vegetation mapping has been converted to Biometric Vegetation Types by Eco Logical Australia ecologists, and the resulting digital data layers interrogated.



Figure 18: 'Region' Derived from Adjacent CMA Subregions

As described above, different scales were used to help determine the overall abundance of each vegetation type due to the absence of vegetation mapping across the „region“. The scales (and associated data layers) that were assessed include:

- Wyong LGA vegetation mapping (Bell 2002)
- Lower Hunter Central Coast Regional Environmental Management Strategy vegetation mapping (LHCCREMS) (NPWS 2000)

Although data across the „region“ was not available, ELA are confident that the data used captures the majority of the local Swamp Mahogany swamp forest on coastal lowlands of the North Coast and northern Sydney Basin vegetation types, as this vegetation type is predominantly coastal, and would be largely incorporated into the mapping used.

The results of the analysis for each vegetation type can be seen in Table 15 and Figure 19.

Table 15: Relative Abundance of Swamp Mahogany swamp forest in Surrounding Regions

| Biometric Vegetation Type | Area of Impact (ha) | Area in Wyong LGA (ha) | Area in REMS Study Area (ha) | Total Area (ha) |
|--|---------------------|------------------------|------------------------------|-----------------|
| Swamp Mahogany swamp forest on coastal lowlands of the North Coast and northern Sydney Basin | 0.1 | 1,030 | 6,975 | 8,005 |

The results for Swamp Mahogany swamp forest on coastal lowlands of the North Coast and northern Sydney Basin are summarised below:

- 1,030.0ha is recorded within the Wyong LGA. The clearing of 0.1ha represents <0.001% of the total extent of the vegetation type in the Wyong LGA
- 8,005ha is recorded within the LCCREMS study area, to the north of Wyong LGA. The clearing of 0.1ha represents <0.001% of the total extent of the vegetation type in the LCCREMS study area
- In total <0.001% of the extent of Swamp Mahogany swamp forest on coastal lowlands of the North Coast and northern Sydney Basin is impacted by this proposal in the regions assessed

Percent remaining is high

Several data sources were utilised to determine the percent remaining of each vegetation type, again at various scales due to the lack of consistent data across the „region“. The data sources used include:

- DECCW Vegetation Types Database (DECCW, 2008)
- Wyong LGA vegetation mapping (Bell 2002)
- Lower Hunter Central Coast Regional Environmental Management Strategy vegetation mapping (LHCCREMS) (NPWS 2000)

The DECCW Vegetation Types database contains a percent cleared figure for each vegetation type, by CMA. For the other two data sources (where analysis was required) the pre-1750 data for each vegetation type was compared to the extent remaining to determine the percent remaining for the red flagged vegetation type.

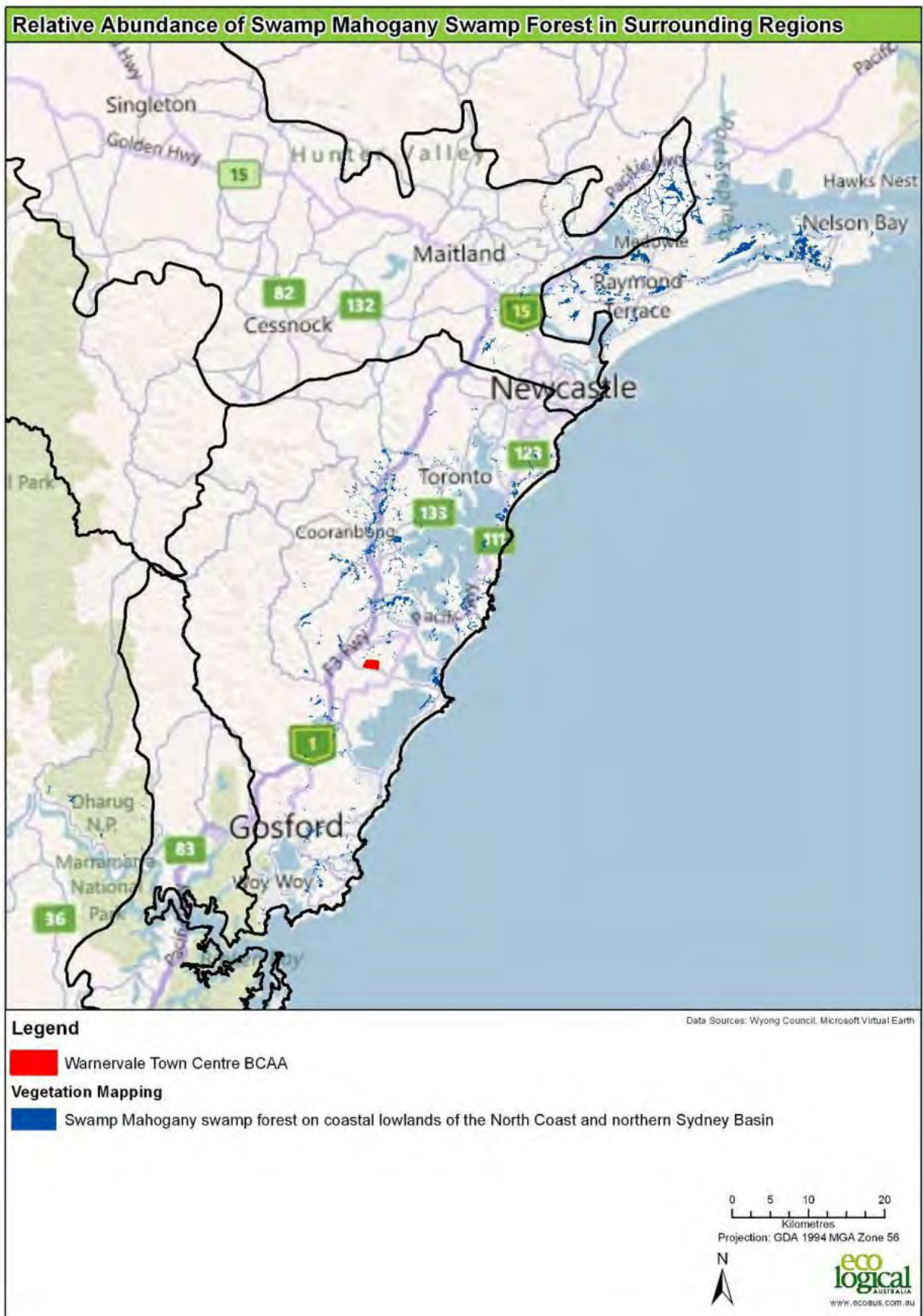


Figure 19: Relative Abundance of Swamp Mahogany Swamp Forest in Surrounding Regions

The results of the analysis are displayed in Table 16. The DECCW vegetation types database records the red flagged vegetation type as 60% cleared within the Hunter Central Rivers CMA region, therefore leaving 40% of each vegetation type remaining. Using the vegetation types in Bell (2002) for the Wyong LGA 34% of the pre-1750 Swamp Mahogany swamp forest on coastal lowlands of the North Coast and northern Sydney Basin remains in the LGA.

The LHCCREMS data indicates 38% of the Swamp Mahogany swamp forest on coastal lowlands of the North Coast and northern Sydney Basin remains across the region.

Table 16: Percent Remaining of Swamp Mahogany swamp forest

| Biometric Vegetation Type | Area of Impact (ha) | % Remaining in HCR CMA | % Remaining in Wyong LGA | % Remaining in LHCCREMS Region |
|--|---------------------|------------------------|--------------------------|--------------------------------|
| Swamp Mahogany swamp forest on coastal lowlands of the North Coast and northern Sydney Basin | 0.1 | 40% | 34% | 38% |

The percent remaining in the regions assessed is between 34-40%. The clearing of 0.1ha will have an insignificant impact on this figure.

Percent native vegetation (by area) remaining is high

The area of native vegetation was calculated for the region, being the Wyong, Hunter, Pittwater and Yengo CMA subregions (Table 17 and Figure 20). The DECCW state-wide vegetation extent layer was used for the assessment (Keith and Simpson, 2006) and was intersected with the four CMA subregions to determine the proportion of each region with native vegetation cover.

Table 17: Native Vegetation Cover of CMA Subregions

| Native Vegetation Cover | Pittwater | Wyong | Yengo | Hunter | Total |
|-------------------------|----------------------|-----------------------|-----------------------|-----------------------|-----------------------|
| Cleared | 15,528 (18%) | 74,753 (36%) | 9,635 (7%) | 339,366 (74%) | 439,283 (49%) |
| Vegetated | 73,000 (82%) | 131,777 (64%) | 128,835 (93%) | 118,400 (26%) | 452,012 (51%) |
| Total | 88,529 (100%) | 206,531 (100%) | 138,470 (100%) | 457,766 (100%) | 891,296 (100%) |

In total, 51% (452,012ha) of the assessment region contains native vegetation cover. The proportion of vegetation cover for three of the CMA subregions is high, with Wyong containing 64% vegetation cover, Pittwater 82% and Yengo 93%. The other CMA subregion, Hunter, has been heavily cleared through in agriculture and mining, and contains only 26% native vegetation cover.

As stated earlier, the vegetation type impacted is predominantly coastal, and therefore very little of each vegetation type is likely to extend into the Hunter CMA subregion. This assessment demonstrates that the majority of the CMA subregions assessed are relatively well vegetated, especially when considering the two coastal CMA subregions (Wyong and Pittwater), which are between 64-82% vegetated.

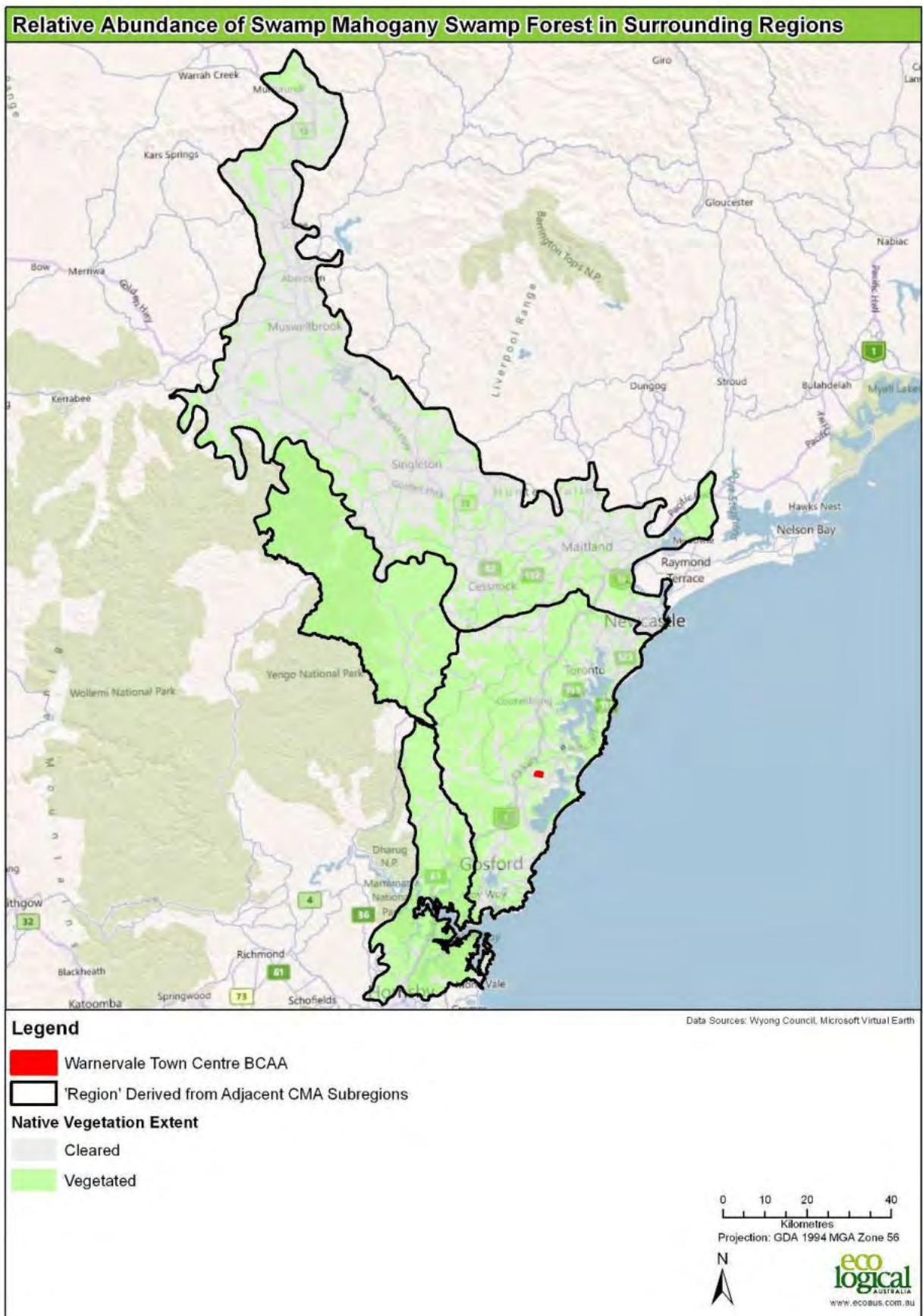


Figure 20: Native Vegetation Extent in Region

Appendix 7: Report on the Use of Certified Local Data Under the Biodiversity Certification Assessment Methodology

INTRODUCTION

This report requests the use of certified local data for *Rutidosia heterogama* (Heath Wrinklewort) in the application of the Biodiversity Certification Assessment Methodology (BCAM) for the proposed certification of the Warnervale Town Centre. The use of certified, local data for the *Rutidosia heterogama* has been considered as it:

- More accurately reflects local environmental conditions
- Is more appropriate to the assessment of the proposed biodiversity certification of the Warnervale Town Centre

BACKGROUND

Under section 3.4 of the Biodiversity Certification Assessment Methodology (BCAM) the use of certified local data is permissible under the following conditions:

The Director General may certify that more appropriate local data can be used instead of the data in the Vegetation Types Database, Vegetation Benchmarks Database and the Threatened Species Profile Database. Local data may be used if the Director-General is of the opinion that the data more accurately reflects local environmental conditions. In certifying the use of local data, the Director General must provide reasons for this opinion.

Benchmark data that more accurately reflect the local environmental conditions for a vegetation type may be collected from local reference sites, or obtained from relevant published sources using the procedures set out in Appendix 2.

The certified local data can then be used in applying the methodology in accordance with any procedures outlined in the Biodiversity Certification Operational Manual.

There are currently no procedures for use of certified local data currently in the Biodiversity Certification Operational Manual.

USE OF MORE APPROPRIATE LOCAL DATA FOR RUTIDOSIA HETEROGAMA

This report provides the reasons for using local data for the assessment of the *Rutidosia heterogama* for the proposed biodiversity certification of the Warnervale Town Centre. It is the opinion of the assessor that this data more accurately reflects the local environmental conditions within the study area, and this information should replace the data available in the Threatened Species Profile Database (TSPD) for the following field:

- „Ability to withstand loss?“ - change the data for *Rutidosia heterogama* within the TSPD from „No“, to „Yes, able to sustain a temporary reduction in numbers“.

REASONS FOR USE OF MORE APPROPRIATE LOCAL DATA

The reasons for the application for the use of local data are provided below. The information demonstrates that *Rutidosia heterogama* is able to withstand a temporary reduction in numbers from the proposed biodiversity certification of Warnervale Town Centre based on;

- the relatively small number of individuals impacted by the proposed biodiversity certification compared to the number of individuals within the region
- the conservation of a relatively high number of the local population within the proposed „Daisy Reserve“ compared to the number impacted on by the proposed certification
- the number of known locations of the *Rutidosia heterogama* within the CMA sub-region.

Provided below is an outline of the species ecology, an assessment of its regional abundance, and a description of the impact caused to the species and the offsets required.

Distribution and status

Rutidosia heterogama is listed as vulnerable on both the NSW Threatened Species Conservation Act 1995 (TSC Act) and Commonwealth Environmental Protection and Biodiversity Conservation Act 1999 (EPBC Act).

The species is scattered across several coastal locations from Wyong to Evans Head, and also occurs within the New England Tablelands region from Torrington and Ashford to Wandsworth, south-west of Glen-Innes (www.threatenedspecies.nsw.gov.au). The species grows in heath vegetation types on sandy soils, in most areas in open forest and has been recorded in disturbed areas (such as road sides and railway sidings).

Threats to the species include habitat loss and fragmentation, fire, trampling and picking, low numbers and unsuitable roadside management (www.threatenedspecies.nsw.gov.au).

Regional abundance

Atlas of NSW Wildlife data was used to gain a regional perspective for the species. The regions assessed include:

- The Wyong CMA subregion
- The Hunter/Central Rivers CMA region

While the best available data has been used to prepare this report, it is important to acknowledge the Atlas of NSW Wildlife does not identify all locations where a species may be present, and only indicates areas where surveys have been completed and the data recorded. In addition, the number of individuals recorded in the Atlas of NSW Wildlife data is unlikely to be highly accurate, and this information is therefore used as a general guide, and not in absolute terms.

As discussed previously (Section 3.6.2), at a local scale 4,980 individuals have been estimated both within and surrounding the WTC BCAA (ELA 2011). The proposed biocertification of the WTC will impact on 114 *Rutidosia heterogama* individuals, which accounts for only 2.3% of the total local population (Figure 21).

An assessment of the Wyong CMA subregion identified seven distinct known populations of the species, with the species most abundant within the Warnervale Town Centre BCAA. Other significant populations have been identified at locations including south-west of Morisset, within Munmorah SCA, within Glenrock SCA and west of the WTC site at Charmhaven (Figure 22).

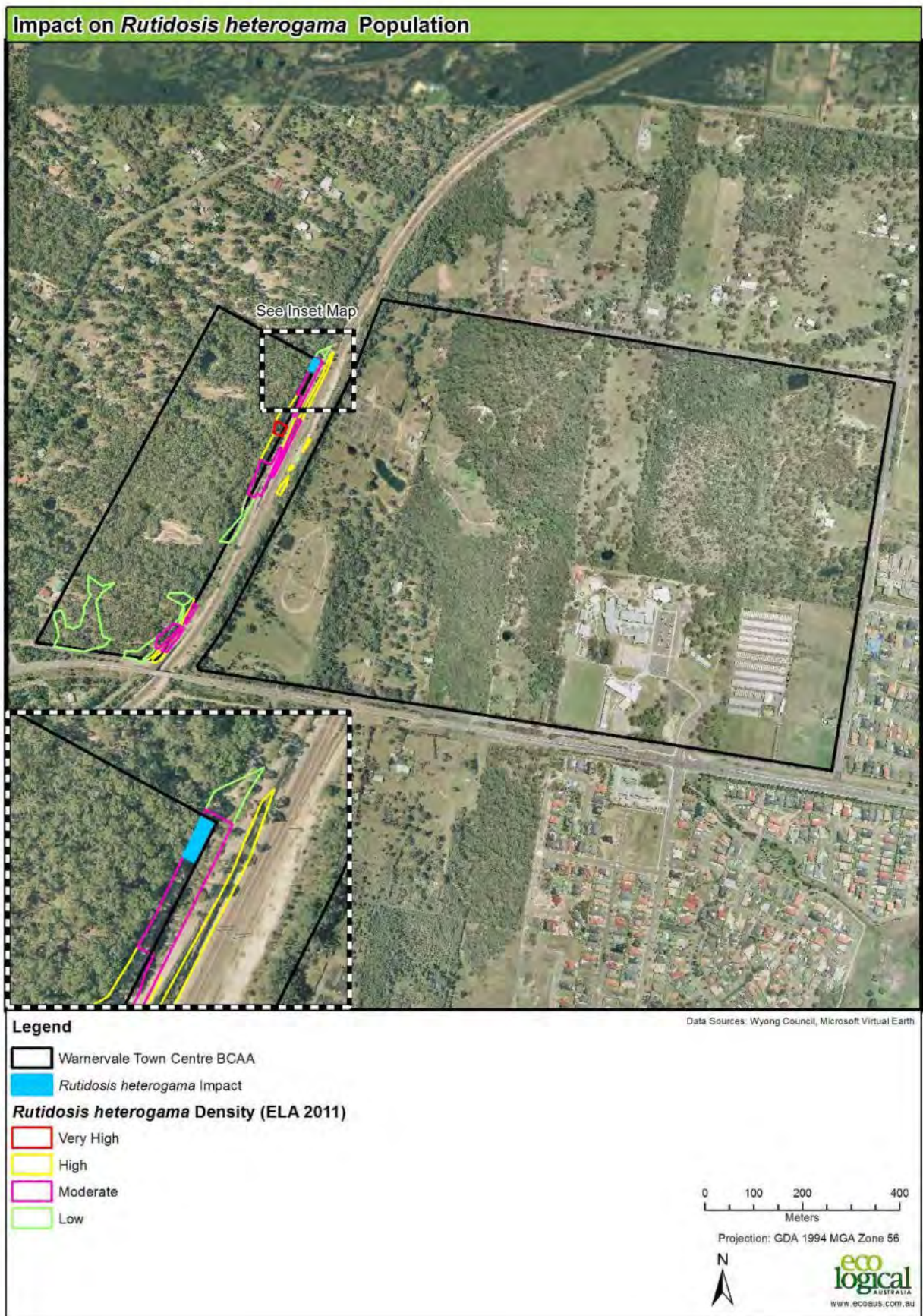


Figure 21: Impact on *Rutidosia heterogama* Population



Figure 22: Extent of *Rutidosia heterogama* in Wyong CMA Subregion

An assessment of the Hunter/Central Rivers CMA was then completed. Within the region 1,154 records are present, containing approximately 17,904 individuals. Most records are centered on the Cessnock area, with significant populations to the south, east and north-east (Figure 23). The clearing of 114 *Rutidosia heterogama* individuals, therefore, represents a maximum of 0.6% of the total number of individuals within the Hunter/Central Rivers CMA region.

Impact caused by biodiversity certification of WTC

The total mapped local population is estimated at 4,980 individuals (ELA 2011) within (and directly surrounding) the WTC BCAA. The proposed road impacts on 114 *Rutidosia heterogama* individuals. This proposed impact on the local population is therefore considered relatively minor, with impacts to 114 individuals representing only 2.3% of the total local population.

The proposed Daisy Reserve (assessed as retained land in this biodiversity certification assessment) will conserve and manage an estimated 3,846 individuals. The reserve will therefore protect approximately 77% of the total population within and surrounding the WTC BCAA. This number of individuals protected within the Daisy Reserve would be expected to increase with the proposed management of the reserve, as the management actions to be applied will be undertaken specifically for the *Rutidosia heterogama*.

Impact requires offsetting

As part of the Warnervale Town Centre biodiversity certification strategy, the impacts to 114 *Rutidosia heterogama* individuals will require an offset containing the species at another location. It is estimated that between 300-325 *Rutidosia heterogama* individuals will be required to satisfy the credit requirement for the species.

The offset site will be secured by a conservation measure and the ongoing management of the species is expected to lead to an increase in *Rutidosia heterogama* individuals on the offset site. The number of *Rutidosia heterogama* individuals across the region, therefore, are likely to sustain a temporary loss across the region.

CONCLUSION

A threatened species is generally identified in the TSPD as not being able to withstand any loss within a CMA (ie, "No" in the "Able to withstand loss?" column) if the species is known to occur in less than three populations within that CMA. Other factors that may be considered are whether the species is:

- (i) naturally very rare,
- (ii) critically endangered,
- (iii) has few populations or a restricted distribution,
- (iv) the species or habitat needs are poorly known,

From the evidence provided above *Rutidosia heterogama* occurs in more than three populations within the Hunter/Central Rivers CMA, with significant populations around the Cessnock area and sites closer to the WTC.

In addition, the Threatened Species Characteristics spreadsheet (ThsppcharaCMA.xls) downloaded from the OEH website states that the *Rutidosia heterogama* is not very rare or poorly known. The species is also not listed as critically endangered, but is listed as vulnerable in under the NSW Threatened Species Act 1995 and Commonwealth Environmental Protection and Biodiversity Conservation Act 1999.

It is the opinion of the assessor that, when considering the specific details of the WTC assessment, the local population of *Rutidosis heterogama* can withstand a temporary loss for the reasons listed above. This application to use certified local data is therefore submitted for the WTC biocertification assessment.



Figure 23: Extent of *Rutidosia heterogama* in HCR CMA Region

Appendix 8: WTC Credit Calculations

| Vegetation type name | Vegetation Formation | Condition (low or moderate/good) | Ancillary code (optional) | Current Site Value Score for vegetation zone | Change in Site Value in certified areas (loss) | Landscape Tg | Predicted Site Value with conservation measures (gain) | Change in site value with conservation measures | 10% current SV past good management |
|--|---|----------------------------------|---------------------------|--|--|--------------|--|---|-------------------------------------|
| Blackbutt - Turpentine open forest of the foothills of the North Coast | Wet sclerophyll forests (grassy sub-formation) | MG | Good | 87.0 | 0.0 | 0.54 | 97 | 10.0 | 8.7 |
| Smooth-barked Apple - Red Bloodwood open forest on coastal plains on the Central Coast, Sydney Basin | Dry sclerophyll forests (shrubby sub-formation) | MG | Poor | 31.0 | 0.0 | 0.55 | 51 | 20.0 | 3.1 |
| Smooth-barked Apple - Red Bloodwood open forest on coastal plains on the Central Coast, Sydney Basin | Dry sclerophyll forests (shrubby sub-formation) | MG | Moderate | 65.0 | 0.0 | 0.55 | 78 | 13.0 | 6.5 |
| Smooth-barked Apple - Red Bloodwood open forest on coastal plains on the Central Coast, Sydney Basin | Dry sclerophyll forests (shrubby sub-formation) | MG | Good | 63.0 | 0.0 | 0.55 | 77 | 14.0 | 6.3 |
| Spotted Gum - Grey Ironbark open forest on the foothills of the Central Coast, Sydney Basin | Dry sclerophyll forests (shrub/grass sub-formation) | MG | Moderate | 56.0 | 0.0 | 0.56 | 59 | 3.0 | 5.6 |
| Spotted Gum - Grey Ironbark open forest on the foothills of the Central Coast, Sydney Basin | Dry sclerophyll forests (shrub/grass sub-formation) | MG | Good | 75.0 | 0.0 | 0.56 | 77 | 2.0 | 7.5 |
| Swamp Mahogany swamp forest on coastal lowlands of the North Coast and northern Sydney Basin | Forested Wetlands | MG | Good | 87.0 | 0.0 | 0.55 | 98 | 11.0 | 8.7 |

| Assess Change in Landscape Value | | | | | |
|--|--|--|--|-------------------------------|-------------------------|
| Landscape Value score for impacts of biodiversity certification | | | | | |
| 1000 ha assessment circle name | 1000 ha circle scaling factor | % NV remaining in 1000ha assessment circle (pre) | Connectivity (pre biodiversity certification) | Adjacent remnant area score | Current Landscape Value |
| 1 | 1 | 15 | 6 | 10 | 31 |
| Future Landscape Value score (post biodiversity certification) | | | | | |
| % NV remaining in 1000ha assessment circle (post) | Connectivity (post biodiversity certification) | Change (loss) in Landscape value score | Area Proposed for biodiversity certification | | |
| 13 | 0 | 18 | 68.4 | | |
| Landscape Value score for conservation measures | | | | | |
| Score for area of land proposed as a conservation measure | Connectivity value score | Adjacent remnant area score | Landscape Value score with conservation measures | Area of Conservation Measures | |
| 0 | 0 | 0 | 0.0 | 0.0 | |

| Area Summary | | | | | | | | | | | |
|---|--|---|----------------------------------|---------------------------|------------------------------|--|--|--|---|------------------------------------|--|
| Total area | | 68.4 | | | | | | | | | |
| Total area proposed for biodiversity certification (ha) | | 68.4 | | | | | | | | | |
| Total area proposed for conservation measures (ha) | | 0.0 | | | | | | | | | |
| Vegetation Zone Id | Vegetation type name | Vegetation Formation | Condition (low or moderate/good) | Ancillary code (optional) | Area of vegetation zone (ha) | Area of vegetation zone to be certified (ha) | Area of vegetation zone in conservation measures | Ecosystem Credits required for certification | Credits Created for funded and managed offset | Credits Created for managed offset | Credits Created for planning instrument offset |
| 1 | Blackbutt - Turpentine open forest of the foothills of the North Coast | Wet sclerophyll forests (grassy sub-formation) | MG | Good | 6.6 | 6.6 | 0 | 296 | #DIV/0! | #DIV/0! | #DIV/0! |
| 2 | Smooth-barked Apple - Red Bloodwood open forest on coastal plains on the Central Coast, Sydney Basin | Dry sclerophyll forests (shrubby sub-formation) | MG | Poor | 12.5 | 12.5 | 0 | 232 | #DIV/0! | #DIV/0! | #DIV/0! |
| 3 | Smooth-barked Apple - Red Bloodwood open forest on coastal plains on the Central Coast, Sydney Basin | Dry sclerophyll forests (shrubby sub-formation) | MG | Moderate | 24.4 | 24.4 | 0 | 831 | #DIV/0! | #DIV/0! | #DIV/0! |
| 4 | Smooth-barked Apple - Red Bloodwood open forest on coastal plains on the Central Coast, Sydney Basin | Dry sclerophyll forests (shrubby sub-formation) | MG | Good | 8.8 | 8.8 | 0 | 292 | #DIV/0! | #DIV/0! | #DIV/0! |
| 5 | Spotted Gum - Grey Ironbark open forest on the foothills of the Central Coast, Sydney Basin | Dry sclerophyll forests (shrub/grass sub-formation) | MG | Moderate | 8.5 | 8.5 | 0 | 251 | #DIV/0! | #DIV/0! | #DIV/0! |
| 6 | Spotted Gum - Grey Ironbark open forest on the foothills of the Central Coast, Sydney Basin | Dry sclerophyll forests (shrub/grass sub-formation) | MG | Good | 7.5 | 7.5 | 0 | 285 | #DIV/0! | #DIV/0! | #DIV/0! |
| 7 | Swamp Mahogany swamp forest on coastal lowlands of the North Coast and northern Sydney Basin | Forested Wetlands | MG | Good | 0.1 | 0.1 | 0 | 4 | #DIV/0! | #DIV/0! | #DIV/0! |
| Totals | | | | | 68.4 | 68.4 | 0.0 | 2190 | #DIV/0! | #DIV/0! | #DIV/0! |

| Species Name | Tg | Individuals/Area to be certified | Individuals/Area in conservation measures | Credits Required | Credits Created for funded and managed offset | Credits Created for managed offset | Credits Created for planning instrument offset |
|----------------------|---|----------------------------------|---|------------------|---|------------------------------------|--|
| Wallum froglet | 0.75 | 0.16 | 0.0 | 2 | 0 | 0 | 0 |
| Rutidosis heterogama | 0.65 | 114.0 | 0.0 | 1,754 | 0 | 0 | 0 |
| | | | | | | | |
| Species Name | Credit status - funded & managed offset | Credit status - funded offset | Credit status - planning instrument | | | | |
| Wallum froglet | -2 | -2 | -2 | | | | |
| Rutidosis heterogama | -1,754 | -1,754 | -1,754 | | | | |

Appendix 9: Credit Converter

| Step 1 - List the outstanding credit requirements | | | | | Next step >> |
|--|--|---|---|---|--------------|
| Species credits | | | | | |
| Number of different threatened species to offset | 2 | select the number of species using the drop-down in cell B3 | | | |
| Species Name | Outstanding number of species credits required | Threatened species response to gain value (Tg value) | Total area of the polygon(s) identified for the species in the assessment | Estimated area of land required to offset outstanding species credits | |
| <i>Wallum froglet</i> | 2 | 0.75 | 0.16 | 0 | |
| <i>Rutidosia heterogama</i> | 1754 | 0.65 | 0.02 | 0 | |
| Total number of outstanding species credits | 1756 | Sub-total of the area of land required to offset outstanding ecosystem credits | | 0 | |
| Ecosystem credits | | | | | |
| Number of different vegetation types to offset | 4 | select number of vegetation types using the drop-down in cell B18 | | | |
| Vegetation type and/or code | Vegetation formation | Outstanding number of ecosystem credits required | Median ecosystem credits created per hectare | Area of land required to offset outstanding ecosystem credits | |
| Blackbutt - Turpentine open forest of the foothills of the | Wet sclerophyll forests (grassy | 296 | 9.3 | 31.8 | |
| Smooth-barked Apple - Red Bloodwood open forest on | Dry sclerophyll forests (shrubby | 1355 | 9.3 | 145.7 | |
| Spotted Gum - Grey Ironbark open forest on the foothills | Dry sclerophyll forests | 536 | 9.3 | 57.6 | |
| Swamp Mahogany swamp forest on coastal lowlands of | Forested Wetlands | 4 | 9.3 | 0.4 | |
| Total number of outstanding ecosystem credits | | 2191 | Sub-total area of land to offset outstanding ecosystem credits | 235.6 | |

Step 2 - Summary of hectares required for outstanding credit requirement

Next step >>

| Species credit summary | estimated area of land ha (from step 1) | is their habitat available in ecosystem credit offset yes/no | if yes, no. of ha | if yes, indicate veg type from list below | area of habitat required for the species |
|---|---|--|-------------------|---|--|
| <i>Wallum froglet</i> | 0 | Yes | 0 | Swamp Mahogany | 0 |
| <i>Rutidosia heterogama</i> | 0 | Yes | 0 | Smooth-barked Apple | 0 |
| Number of hectares required for all remaining species credits | | | | | 0 |

Ecosystem credit summary

| List of vegetation types (from step 1) | Formation (from step 1) | ha (from step 1) |
|--|---|------------------|
| Blackbutt - Turpentine open forest of the foothills of the North Coast | Wet sclerophyll forests (grassy sub-formation) | 31.8 |
| Apple - Red Bloodwood open forest on coastal plains on the Central Coast, Sydney Basin | Wet sclerophyll forests (shrubby sub-formation) | 145.7 |
| Gum - Grey Ironbark open forest on the foothills of the Central Coast, Sydney Basin | Dry sclerophyll forests (shrub/grass sub-formation) | 57.6 |
| Swamp Mahogany swamp forest on coastal lowlands of the North Coast and northern Sydney Basin | Forested Wetlands | 0.4 |
| Number of hectares required for all remaining ecosystem credits | | 236 |

Number of hectares required for all remaining ecosystem credits and species credits

236

| Step 3 - Calculate the financial contribution | | | |
|--|------------------------------------|---|---|
| Total hectares required for all remaining ecosystem credits and species credits (calculated from Step 2) | | 236 | |
| Total offset area required that is to be secured via a financial contribution (i.e. total ha required divided by 0.90) | | 262 | |
| Select the proposed offset location/s | | Total offset area from the locations selected below | 262 |
| Number of different locations in which the offset is likely to occur? | | 1 | select the number of locations using the drop-down in cell C5 |
| Location in which the conservation measure is likely to occur (using land values from the Valuer General) | Land value per ha for the location | Area of land to be sourced at this location | Financial contribution required to purchase the area of land at this location |
| Blank | \$0 | | \$0 |
| Total | | 0 | \$0 |
| Or choose other locations in which the offset is likely to occur? | | 4 | select the number of locations using the drop-down in cell C14 |
| Other nominated locations in which the conservation measure is likely to be located | Land value per ha for the location | Area of land to be sourced at this location | Financial contribution required to purchase the area of land at this location |
| Wyong | \$10,000 | 100 | \$1,000,000 |
| Wyong | \$10,000 | 100 | \$1,000,000 |
| Wyong | \$12,500 | 40 | \$500,000 |
| Wyong | \$15,000 | 22 | \$330,000 |
| Total | | 262 | \$2,830,000 |
| Average management costs per hectare | | \$3,250.00 per hectare | |
| Total management costs | | \$852,216 | |
| Amount required to purchase land from the nominated location/s plus total management costs | | \$3,682,216 | |
| Administration fee for the financial contribution (based on 10% of the amount required to purchase land from the nominated location/s) | | \$283,000 | |
| Total financial contribution required | | \$3,965,216 | |



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