Bioregional Assessment Study Part I

Native Vegetation of the Illawarra Escarpment and Coastal Plain

A project arising from the Commission of Inquiry into the long term planning and management of the Illawarra Escarpment, Wollongong Local Government Area

Central Conservation Programs and Planning Division
NSW National Parks and Wildlife Service
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Native Vegetation of the Illawarra Escarpment and Coastal Plain

Wollongong Local Government Area Bioregional Assessment (Part I)

2002

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1 INTRODUCTION

1.1 BACKGROUND

In 1999 a Commission of Inquiry was held into long-term land use planning along the Illawarra Escarpment. A number of issues were raised concerning the level of development in the escarpment and foothills. In December 2000, the NSW Government endorsed the recommendations presented in the Commissioner's Report. One of the key recommendations included the preparation of an Illawarra Escarpment and Foothills Management Plan. This plan would draw on a number of concurrent studies to guide long term planning and management of the escarpment. These studies cover

- Riparian and floodplain management;
- Regional Vegetation Management;
- A Land Stability Study;
- A Bioregional Assessment Study; and,
- A review of the Illawarra Regional Environmental Plan No.1.

These projects, managed by State Government Agencies and Wollongong City Council, propose to "assist in updating and bringing together the knowledge and understanding of the conservation values and regional environmental significance of the area as well as the opportunities and constraints to development."

1.2 BIOREGIONAL ASSESSMENT STUDY

The National Parks and Wildlife Service (NPWS) is the agency responsible for the completion of the Bioregional Assessment project. The Bioregional Assessment Study refers to the collection and analysis of flora and fauna data required to identify, describe and map vegetation communities and fauna habitats within the Wollongong Local Government Area (LGA). These information layers, used in conjunction with agreed conservation assessment criteria, will provide for the identification of conservation values across the LGA. This work will underpin a number of planning exercises proposed as part of the Illawarra Escarpment Management Plan. These include regional vegetation management planning, riparian corridors planning and broad land-use planning across the LGA including options for future reserve design.

This report deals with the first component of the Bioregional Assessment: Vegetation Classification and Mapping.

1.3 VEGETATION CLASSIFICATION AND MAPPING OBJECTIVES

This project aims to

- Develop a classification system that describes vegetation communities along the Illawarra Escarpment and Foothills using systematic field data and quantitative analytical methods;
- Describe the floristic composition of the defined vegetation communities and their habitat characteristics;
- Examine relationships between the vegetation communities described in the Study Area to those occurring elsewhere in the Sydney Basin Bioregion;
- Delineate the extent of native vegetation cover using recent large-scale aerial photography;
- Map the current distribution of the vegetation communities defined in aims 1 and 2;
- Examine the reservation status of each of the vegetation communities within both local and regional contexts;
- Map the intensity and type of disturbance present within vegetation cover in the Study Area using recent large-scale aerial photography.

Classifying and mapping vegetation in NSW has been undertaken using a wide variety of methods and approaches (FEWG, 1997). Each method comes with strengths and weaknesses in terms of accuracy, efficiency and rigour. The adoption of systematic field methods provides an explicit and repeatable means to describe recurring patterns in floristic assemblages, hereafter termed Vegetation Communities. These methods afford the application of quantitative classification techniques that provide robust supporting data to vegetation community definition. In addition, comparison and assessment of broader regional vegetation patterns is more easily achieved and is less clouded by subjective judgements.

The use of systematic data collection techniques for these purposes is well-documented (Benson, 1999; FEWG, 1997). In recent years the commitment to the collection and storage of such data has been supported and encouraged by statewide projects such as the Comprehensive Regional Assessments (CRA) and mapping arising from the Native Vegetation Conservation Act. The Illawarra Bioregional Assessment Study falls within the NPWS's ongoing commitment to the collection of such data. In this way data can be used and reused for a range of different purposes and analyses. Importantly, the sampling of vegetation for this project will support preparation of a "part-plan" Regional Vegetation Management Plan for the Wollongong LGA. The data collected will also be used in the broader NPWS/DLWC "Priority 5 Mapping Area" project (part of DLWC's statewide Native Vegetation Mapping Program), which is mapping native vegetation across the wider "Greater Illawarra/Southern Highlands native vegetation region."

Mapping of Vegetation Communities defined by field data is always a process of extrapolation. In this project, Aerial Photo Interpretation has been used to assist in this process by drawing on relationships between field observations and patterns identifiable from aerial photos. It has also been used to delineate the boundaries of vegetation cover in detail to ensure that the information generated is useful for planning purposes. Finally, it has been used to provide a coarse index of the patterns in disturbance levels present amongst the vegetation cover of the Study Area.

1.4 STUDY AREA

The primary focus of the Commission of Inquiry has been on the Escarpment and Foothills of the Wollongong LGA. NPWS has adopted a broader view of the Study Area to include coastal floodplains, estuaries and other coastal environments. Data beyond the immediate area of interest provides decision-makers with greater context for planning decisions. Such context improves our understanding of the relative conservation status of biodiversity attributes as well as providing supporting evidence of potential linkages and networks that may support conservation goals.

Detailed vegetation sampling and mapping has been completed to cover an area from the sandstone plateau edge to the coast. The Southern limit has been marked by the southern boundary of Lake Illawarra and the Macquarie Rivulet so that the Calderwood Valley could be included in its entirety. In the north of the LGA detailed mapping has been extended to include Bulgo Beach near Otford and the Helensburgh area east of the Freeway. Map 1 shows the boundary of the detailed vegetation mapping Study Area in relation to the Study Area.

1.5 REGIONAL CONTEXT

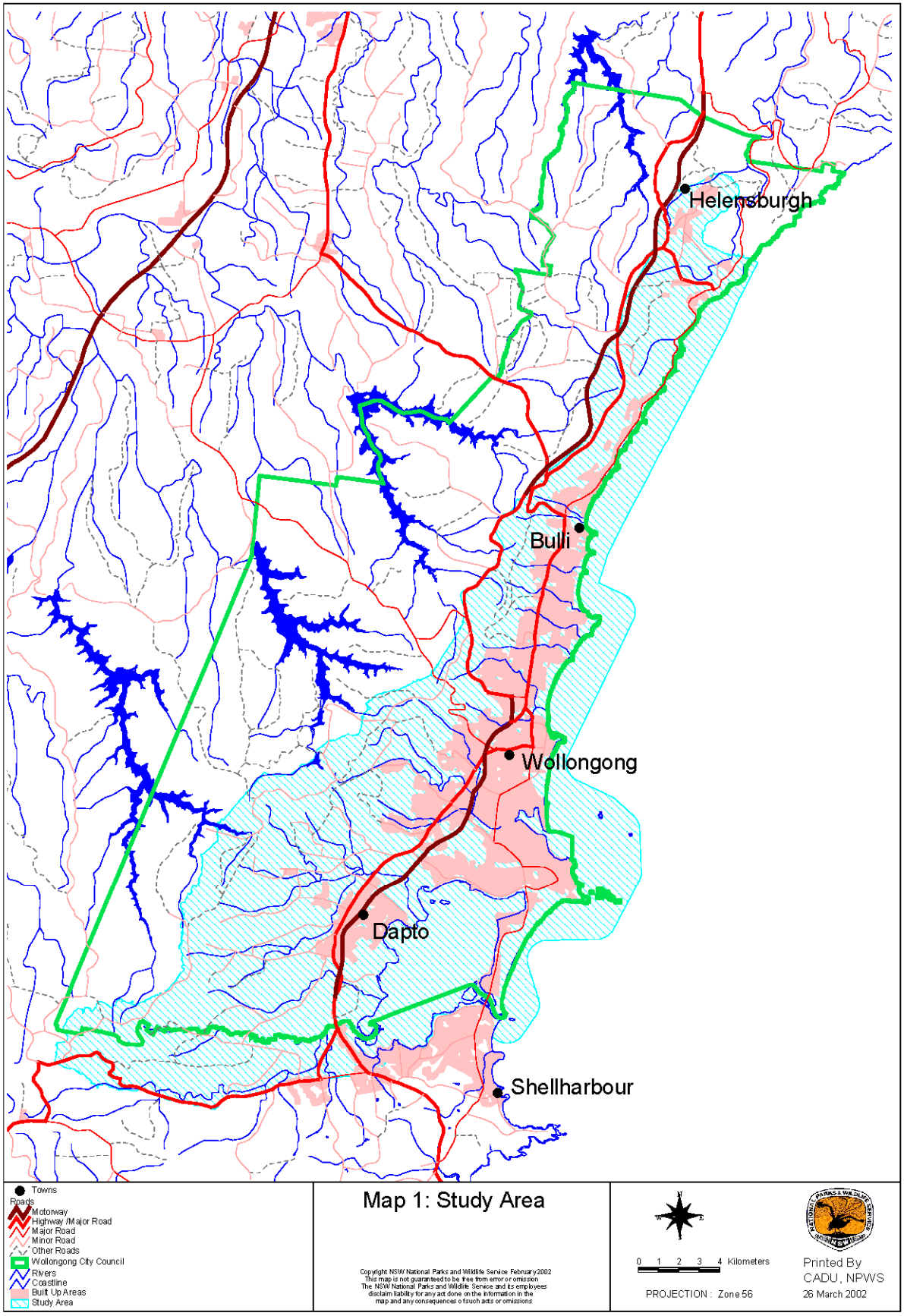
The Wollongong LGA is situated within the Sydney Basin Bioregion (Thackway & Creswell, 1995). It has been identified as one of 80 Australian Bioregions in the Interim Biogeographic Regionalisation of Australia (IBRA). These Bioregions are identified and mapped on the basis of similarity between climatic, geological and vegetation features. Map 2 illustrates the location of the Sydney Basin Bioregion in NSW. It extends from between Batemans Bay and Ulladulla on the South Coast to the Hunter Valley and west to include the Blue Mountains Sandstone Plateaux. The position of the Study Area with the Bioregion is also show in Map 2.

The IBRA was implemented to examine the reservation status of broad regions to assist with the ongoing development of a National Reserve System. It provides a useful context for examining the conservation status of vegetation communities within the Study Area in a consistent and rigorous manner.

1.6 PROJECT TEAM

This project was completed by the Conservation Assessment and Data Unit, Central Programs and Planning Division, NPWS. This project was coordinated by Daniel Connolly. Christopher Pennay and Daniel Connolly produced this report. Jedda Lemmon undertook survey planning and logistics. Christopher Pennay and Daniel Connolly undertook data analysis. Peter Ewin undertook geographic information system (GIS) and data base management. Field survey was undertaken by Christopher

Pennay, Jedda Lemmon, David Thomas, Daniel Connolly and Peter Ewin. Aerial photograph interpretation and data capture was undertaken by Ian Roberts and Spatial Vision. Joshua Madden completed data entry. NPWS Illawarra Area staff have provided ongoing support to the project.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Rivers
Coastline
Built Up Areas
Study Area
Map 1: Study Area
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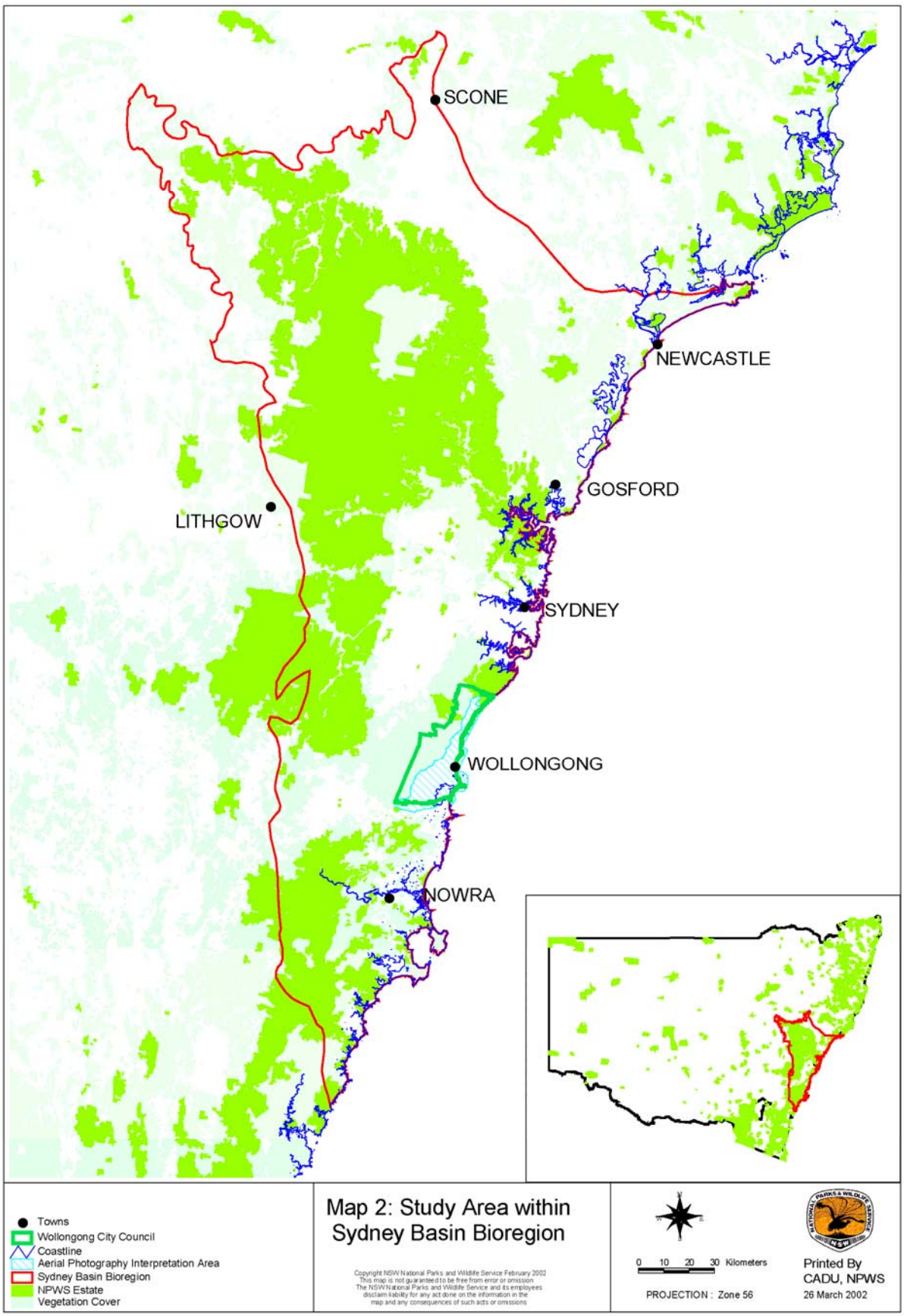
SCONE
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WOLLONGONG
NOWRA
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Wollongong City Council
Coastline
Aerial Photography Interpretation Area
Sydney Basin Bioregion
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Vegetation Cover
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2 METHODS

2.1 REVIEW OF EXISTING DATA

A review of existing information serves two purposes. Firstly, existing information provides important descriptions and supporting information that guides survey design, implementation and vegetation classification. Secondly, the review can highlight existing systematic site data that can be used to augment data collected for this project.

Most reports met the first purpose. A number of these have been invaluable. These include Fuller (1980), Fuller & Mills (1998), Mills & Jakeman (1995), NCC (1999), Chafer (1997) and Floyd (1990). However, less data was available in a systematic format that could be directly used during the analytical stages of this project. Datasets that provided commensurate systematic data and fell within the Study Area are restricted to those carried out by Sydney Catchment Authority in the Metropolitan Catchments and by NPWS in Royal National Park and Dharawal State Conservation Area (NPWS, 2001). Systematic data was also available for regional analyses from Western Sydney and the Lower Hunter and Central Coast. These datasets were used to provide regional context to vegetation assemblages present in the LGA. Table 2.1 provides an overview of sites used in the regional analyses and their source.

TABLE 2.1: EXISTING REGIONAL SITE DATA

Area	Source	Number of Sites
Cumberland Plain, Western Sydney	NPWS (2000d)	403
Royal National Park	D. Keith	276
Woronora and Metropolitan Catchments	SCA	347
Dharawal State Conservation Area	Keith (1994)	56
Lower Hunter and Central Coast Region	NPWS (2000b)	354

2.2 SURVEY STRATIFICATION AND SITE SELECTION

The selection of field survey sites were based on combinations of Soil Landscapes (Hazelton *et al*., 1990), aspect and drainage. These combinations, known as stratum, were derived in a Geographic Information System (GIS) and described 86 potential sampling combinations. Sites were allocated proportionally to the area each stratum occupied in the LGA prior to clearing. This ensured that sufficient replication was sought for those communities for which little remnant vegetation remains. All existing sites were located against the stratum to ensure that new survey work did not replicate previous research.

Sampling performance was reviewed against Geological Maps (1:50 000 series) and against the major vegetation patterns interpreted from aerial photos. Sampling for some strata combinations was limited by the small areas of remnant vegetation present or by access constraints.

Sites were selected to minimise travel times while maximising sampling options for different vegetation types. Land ownership details were obtained from Wollongong City Council. Owners were contacted by phone to obtain permission to access properties. Where access was approved, the area was marked on a topographic map and later surveyed.

Field survey sought to sample areas that were reflective of the surrounding vegetation and were relatively free of obvious disturbance. The condition of some vegetation types is disturbed across most of its distribution in the Study Area. In such cases, sampling was still carried out unless the remnant was clearly dominated by weeds and/or lacking structural integrity.

Field sampling was completed between March and May 2001 with some sites completed to refine communities in August 2001. Sampling was carried out in teams of two persons. Species that could not be identified in the field were recorded to the nearest possible family or genera and tagged for later identification. Species that could not be identified accurately were sent to the NSW Herbarium for resolution.

2.3 FIELD METHODS

Standard field sites fixed to 0.04 hectares were adopted. The area was marked out using a 20 by 20 metre quadrat, although some riparian communities were sampled using 10 by 40 metre sample areas. At each site all vascular plant species were recorded and assigned a cover abundance score using a modified seven point Braun-Blanquet scale (Poore, 1955):

1-Rare, few individuals (three or less) present and cover <5%;

2-Uncommon (more than three but not consistently throughout plot) and <5% cover;

3-Common (consistent throughout plot) and <5%;

4a-Very Abundant and Cover <5% OR **4b**-Cover >5% and <25%;

5-Cover >25% and <50%;

6-Cover >50% and <75%;

7-Cover >75%.

Estimates were made of the height, cover and dominant species of each stratum. Measurements of slope, aspect, and horizon azimuths were taken. Notes on geology, disturbance and soil were compiled.

2.4 SITE NOMENCLATURE

For the purpose of managing existing and new field data each survey plot was given an 8-digit alphanumerical survey identification number, taken from a system used by Bell *et al.* (1993). A separate survey identification code was given to all data to distinguish its source. Using this system enables the reader to understand basic geographical information about the survey site.

Example:

W	L	L 0 7	N			3	C

The first three letters "WLL" refer to the first three consonants in the 1:25 000 map sheet name; in this case the Wollongong Map Sheet

The fourth and fifth digits "07" refer to the site number, ie. The seventh site on this map sheet

The sixth character "N" refers to the geology using the following categories. In this case Narrabeen Sandstone.

N = Narrabeen sandstone

H = Hawkesbury sandstone

W = Wianamatta shale

B = Basalt

A = Alluvium

Q = Quaternary sand

P = Permian sediments

T = Talus Slope (Escarpment slopes)

I = Illawarra Escarpment

S = Budgong Sandstones

The seventh character "3" refers to the aspect using the following categories.

1 = 67.6 –112.5 degrees

2 = 112.6 – 157.5 degrees

3 = 157.6 – 202.5 degrees

4 = 202.6 – 247.5 degrees

5 = 247.6 – 292.5 degrees

6 = 292.6 – 337.5 degrees

7 = 337.6 – 22.5 degrees

8 = 22.6 – 67.5 degrees

The eighth character "C" refers to the morphology codes as used in the field survey proforma (see Appendix E).

C = Crest

U = Upper Slope

L = Lower Slope

M = Mid Slope

V = Gully

S = Simple Slope

F = Flats

B = Escarpment Bench

2.5 DATABASE ENTRY

Field data was entered into an ACCESS database. Database entry windows were similar to those used for field proformas to minimise entry errors. All species recorded are coded using the Census of Australian Vascular Plant Species (CAPS). New species or subspecies, as identified by the Royal Botanic Gardens, not previously listed in the CAPS were assigned new codes to the master CAPS database.

2.6 AERIAL PHOTO INTERPRETATION

Aerial Photo Interpretation (API) has been used to meet several objectives. These are to:

- accurately estimate the extent of native vegetation cover across the Study Area;
- guide and inform the mapping of vegetation communities derived from field data; and
- provide a relative index of vegetation condition for all native vegetation cover.

Interpretation was tied to explicit mapping rules to ensure consistency in interpretation of features across the Study Area. The mapping rules followed those developed by NPWS (2000d). A skilled air photo interpreter using 1:16 000 scale aerial photos completed the interpretation. Aerial photos were flown in April 2001.

The Aerial Photos were interpreted to provide information on:

- Vegetation Type (API Code)
- Understorey Code
- Reliability
- Disturbance Assessment
- Disturbance Type

All mapped polygons have been each of these attributes described using a code string. An example code string might be

E15.2/C/BZ

The code string can be deconstructed as follows

- E15 refers to the API code of particular canopy species patterns; in this case a Blackbutt Dominant Forest.
- .2 is a reliability code applied to the interpretation of the canopy species patterns; in this case a High level of confidence was placed on the interpretation.

- /C describes the broad understorey characteristics of the polygon; in this case drier shrubs dominate.
- /B describes the intensity of disturbance observable from aerial photos; in this case there is a moderate level of disturbance where >75% of the canopy has integrity but there are single or multiple small canopy gaps.
- Z indicates that the dominant disturbance feature is the presence of weeds.

Other codes may be shorter if they are describing landscape features or exotic vegetation. For example

P/G.1

- P/G indicates a scrub dominated by Lantana camara and Acacia species.
- .1 is a reliability code that indicates the site has been visited.

2.6.1 Patterns in Vegetation Cover

Patterns in vegetation cover vary greatly across the Study Area. The variation ranges from native to introduced vegetation and from fragmented patchy patterns to contiguous extensive cover. All vegetation cover was mapped using consistent criteria as follows:

No Vegetation Cover

This includes obvious features such man made structures, cleared paddocks, parks, ovals, waste depots, industrial premises, etc. Areas mapped with no vegetation cover are excluded from further assessment. Specific non-vegetative features mapped include landslides, coal emplacements, landfills and water bodies. Areas supporting no vegetation cover are coded with the prefix X.

Sparse/Scattered Vegetation Cover

A regular feature of native vegetation cover in disturbed environments is the presence of scattered trees above an open or absent understorey in a mosaic of cleared and remnant vegetation. A code **Tx** was applied where Crown Canopy Projected Density (CCPD) of tree cover fell below ten percent. A minimum mapping area of 0.5 hectares was used. Vegetation cover attributed with the code Tx was further assessed to describe the tree species present and the type of land use occurring under the tree cover, as follows:

Tx/G Scattered trees grazing understorey

Tx/C Scattered trees cultivated understorey

Tx/R Scattered Trees above rural residential

Tx/U Scattered Trees above urban development

Tree cover greater than ten percent Crown Canopy Projection and are greater than 0.5 hectares

All vegetation cover that displays canopy integrity has been mapped. Canopy integrity has been defined as having greater than ten percent CCPD. All vegetation cover falling within this class and with an area greater than 0.5 hectares has been mapped. They cover large expanses of vegetation cover to remnant patches in a cleared landscape. They are attributed with a code describing the canopy species present, the nature of the understorey and the type and intensity of disturbance.

2.6.2 Patterns in Canopy Species

All vegetation cover was allocated a canopy species code based on the dominant combinations of upper strata species. The species combinations were based initially on existing research (Fuller, 1980; Fuller & Mills, 1985; Benson & Fallding, 1985; Keith, 1994; Benson & Howell, 1994; NCC, 1999) then modified during field assessment. A complete table of vegetation patterns identified by API is presented in Appendix D.

2.6.3 Understorey Patterns

Broad classes of understorey characteristics were interpreted where they were visible. These features are described in Table 2.2. Understorey has been collected for a number of reasons. Firstly, it provides an additional layer of information that can be used to more accurately delineate vegetation community distribution. Secondly, it can be used to clarify habitat values for fauna.

TABLE 2.2: API UNDERSTOREY CODES

Understorey Code	Understorey Feature
A	Taller Dense Rainforest Canopy
B	Mesic/Rainforest Shrub Layer
C	Drier Shrubs Dominant
D	Shrubs and Grasses
E	Grasses Dominant
F	*Melaleuca* Dominant
G	*Acacia* Dominant
J	Swampy/Sedgy Ground
K	*Casuarina* Dominant
L	Rock
M	Mangrove Dominant
N	Saltmarsh
P	Lantana
S	Seagrass
U	Quarry
V	Sand
W	Water Body
Z	Weeds

2.6.4 Disturbance Patterns

All vegetation cover was assessed for disturbance. An initial code was applied to indicate the intensity of disturbance based on a subjective assessment using any combination of disturbance patterns observable from the air. Three categories were used, High, Medium and Low. These are described below in Table 2.3. The dominant disturbance type has also been coded.

2.6.5 Interpretation Reliability

One of four classes of interpreter mapping confidence was applied to each mapped polygon. These classes enable users to understand the reliability of the mapping features. The confid ence levels are presented in Table 2.4

TABLE 2.3: DISTURBANCE INTENSITY AND DISTURBANCE TYPE CODES

Interpreters Disturbance Assessment	Indicates the following patterns	Disturbance Feature Code	Disturbance Feature
A-Lowest Disturbance Levels	No visible signs of disturbance from air. Polygon may have some established tracks dissecting. Evidence of weeds may not be visible or only identified during site investigations, generally at low intensity. Gaps in canopy are more likely to be natural dynamic between rainforest/eucalypt structures	Z	Weeds minor (<10% polygon)
		B	Tracks minor
		C	Some evidence of regrowth crowns 0-30%
B-Medium Level of Disturbance	Common to the Study Area, a polygon may exhibit >75% integrity in forest canopy structure but contains features such as single or multiple canopy gaps where weed infestations have developed from light penetration. The polygon may also be marked by several poorly developed trails dissecting path or evidence of human disturbance such as clearing or understorey patchiness	Z	Weeds infestations present in small gaps in canopy (<25% polygon)
		B	Tracks Present High
		C	Tracks Present Low
		D	Regrowth Dominant (>30%)
		E	Regrowth Minor
		F	Soil Disturbance High
		G	Soil Disturbance Low
		H	Understorey Patchy
		I	Land Slip Evidence
C-High Disturbance Levels	Common around areas of previous mining and clearing. Dense weed infestations dominate the understorey or canopy. Structure of vegetation is limited to canopy and dense weed understorey. In some areas canopy may include exotic species amongst natives. Canopy gaps are clearly apparent. Evidence of soil disturbance may be apparent, as may be evidence of previous mining activities or clearing.	Z	Weed infestation clear in large gaps in canopy or across understorey
		B	Tracks Present High
		C	Tracks Present Low

Interpreters Disturbance Assessment	Indicates the following patterns	Disturbance Feature Code	Disturbance Feature
		D	Regrowth Dominant (>30%)
		E	Regrowth Minor
		F	Soil Disturbance High
		G	Soil Disturbance Low
		H	Understorey Patchy
		I	Land Slip Evidence

TABLE 2.4: INTERPRETER MAPPING CONFIDENCE CLASSES

Mapping Confidence Class	Criteria
Class 1: Very High	Polygon Visited, features checked
Class 2: High	Strong correlation of pattern based on extrapolation from adjacent visited polygons
Class 3: Medium	Pattern consistent with general trend although less certainty with some or all of the polygon attributes
Class 4: Low	Feature unusual, API uncertain, unconfident interpretation

2.7 DIGITAL DATA CAPTURE

Aerial Photo Interpretation line work has been completed on transparency overlays within effective areas on each photo frame. Effective areas represent the part of an aerial photo on which there is least spatial distortion and displacement compared to adjacent photographs of the photo run. The delineation of effective areas is particularly important given the sharp relief of the Illawarra escarpment. Considerable distortion between high and low points on the same photo make data transfer difficult. Figure 2.1 provides an example of Aerial Photo Interpretation linework completed within an effective area at Coalcliff. The left margin of the effective area is clearly distorted, however it represents a straight line in three dimensional space.

To transfer the linework to a GIS format, a series of 5 stable film bases were produced in GIS. These base maps indicated roads, streams and contours at a scale of 1:12 500. Original data was sourced from digital line work from LIC 1:25 000 Topographic Maps. An additional map film was produced of orthorectified aerial photos for the Study Area. Mapped linework captured from the 1:16 000 photos were then rescaled using an artiscope camera to 1:12 500 to equate scales with the base maps. Line work was then fair drawn onto the stable film tying polygon relationships in the photos to stream, road and contour features of the base maps.

The mapped linework on the 5 base maps was then redrawn without labels and scanned. Each sheet was scanned using a raster 15 pixel/mm scanner and vectorised into digital data. A digital coverage supporting typology was cleaned and built in ArcInfo. Each polygon was then labelled using the following fields.

- Primary Vegetation Code
- Secondary Vegetation Code
- Reliability
- Understorey 1
- Understorey 2
- Disturbance Assessment
- Disturbance Type

FIGURE 2.1: EXAMPLE OF AERIAL PHOTO INTERPRETATION MAPPING OF AN EFFECTIVE AREA IN COALCLIFF

Appendix C lists all the species recorded during surveys undertaken as part of this project.

2.8 TAXONOMIC REVIEW

For this project, all nomenclature was reviewed and standardised across data sets for analysis. Synonyms for the same taxon were updated to reflect currently accepted revisions. The treatment given in Harden (1990-93) was used as a standard. Recent taxonomic revisions have been identified using the PlantNet website maintained by the Royal Botanic Gardens. The principle outcomes of the taxonomic review follow.

- All exotic species were identified and excluded from the analysis dataset;
- The review highlighted species that were likely to have been incorrectly identified or incorrectly entered into the database. Original field sheets were reviewed to determine the status of these species and where data entry errors were detected, changes were made to the database. Where data entry errors were not detected, species were reviewed against existing literature. Where this indicated them to be outside their likely range, and no confirmation had been made, the record was deleted from the database;
- The review highlighted inconsistently collected records of species containing subspecies or varieties. In such cases, subspecies were either lumped to species level or were assigned to a single subspecies or variant if only one variety is present in the Study Area;
- The review identified species hybrids that are not recognised formally in the literature. These were assigned to one or other of the species based on the predominance of either in proximate environments; and
- The review identified species identified to genus level only. These were deleted from the analysis dataset.

2.9 VEGETATION CLASSIFICATION

Vegetation communities were classified using quantitative data analysis of field data. This analysis involved a number of stages. Firstly, analysis of all raw species abundance data from the 191 full floristic site data was undertaken using the PATN (Belbin, 1994) package. The Bray-Curtis coefficient was generated to identify dissimilarity between survey sites. A large association matrix displaying dissimilarity scores between all pairs of sites was produced. An unweighted pair group arithmetic averaging (UPGMA) clustering strategy was applied to the matrix to derive a hierarchical classification. The default beta value of –0.1 was used on all analyses.

A dendrogram was produced to display the hierarchical relationships between individual sites and groups of sites. Homogeneity analysis (Bedward *et al*., 1992) was used as an initial guide to the variation of floristic data within potential groups of sites. Perfect homogeneity of floristic assemblages within groups would only occur where each site in the data set is considered as an individual group. No two sites in vegetation sampling are ever identical given the natural continuums of vegetation patterns in the landscape. The question facing the analyst is to what degree are differences worthy of justifying unique groups of sites. These decisions are based on field observations and interrogation of site data.

An initial broad grouping of sites provided the start point for further investigation. Groups of sites were examined using the species that characterise the group, structural features such as height and Eucalypt cover along with physical characteristics such as geology, topographic position and aspect. Each broad group was split to uncover finer scale floristic assemblages in a sequential manner. This process was continued until further splits in site groupings did not resolve clearer or more consistent patterns of floristic assemblages.

With groups of sites identified to reflect preliminary vegetation communities, data was reanalysed using a different measure of dissimilarity to examine the fidelity of site groups. In addition, data was transformed from the original raw cover abundance scores to a simple presence-absence dataset. Identical dissimilarity coefficient techniques were performed on the transformed data to again test the robustness of groups. Sites that moved between groups were identified as potential misclassifications and either reallocated to new groups or were left unchanged.

A number of strata occurring on the Woronora Plateau have only been sampled by the Sydney Catchment Authority. In this study, species abundance was measured using a 6 point score as opposed to the 7 point measure used in this study. As a result, this data was analysed separately to identify vegetation community patterns.

Three communities (Floodplain Wetland, Upland Swamps: Mallee-Heath and Riparian River Oak Forest) were not sampled in this study and these were described from existing literature sources (Benson & Fallding, 1985; Chafer, 1997; NCC, 1999).

2.10 VEGETATION COMMUNITY DESCRIPTIONS

Vegetation Communities have been described in detail using a number of features. Firstly, combinations of sites defining unique groups in the cluster analysis were used to identify characteristic flora species. These are presented as a floristic summary in the profiles (Appendix A). Common species in each vegetation layer are provided along with summary height (metres) and cover (total projected canopy cover) percentages.

Each Vegetation Community has been given a Map Unit Name to describe the structure, dominant or characteristic species (generally tree species), broad understorey descriptor and/or a geological or topological feature.

The community profile supports a brief summary of key identifying features. These include abundant and frequently recorded species and habitat characteristics. Example locations are also given, as is a sample photograph from a site used to describe the community in the cluster analysis. The degree of disturbance within the mapped vegetation community is also presented along with figures highlighting the total extant area within the Study Area. Estimates are provided of the extent of the community within the Sydney Basin Bioregion. This has drawn on relationships achieved with site data and qualitative inferences drawn from available mapping resources. These include NPWS (2000a, 2000b, 2000c, 2000d, 2001, 2002), Mills (2001) and Keith (1994).

Site data can also be used to help define the floristic assemblages of a community in relation to all other assemblages present in the Study Area. A concept known as 'fidelity' developed by Keith & Bedward (1999) provides a systematic method for identifying 'diagnostic' or 'characteristic' species within an assemblage. This approach recognises that within a given vegetation community a species may be conspicuous by the frequency and abundance which it is recorded. However, in other communities the species may only occur patchily, at low abundances or not all. These patterns can be quantified by analysing the site data of the Study Area. Table 2.5 describes the criteria used to define diagnostic species using positive, negative, uninformative or constant species. Positive species are recorded more frequently within a community and/or at a higher median cover abundance than in all other vegetation communities. The frequency of a species within a community refers to the proportion of sites classified as that community that include the species. Positive species also include those that are only recorded within the target community irrespective of their frequency of detection or abundance. A species that is present in all other communities but is less common or abundant or not present at all in the target community is defined as a negative diagnostic species. A constant species is one that occurs consistently within many communities. Uninformative are those that are recorded at lower abundance and less frequently across all communities. The profiles provide a summary of all positive, negative and constant diagnostic species.

TABLE 2.5: DEFINITIONS OF DIAGNOSTIC SPECIES

		Occurrence of Species in Residual Map Units		
		Frequency ≥50% AND C/A ≥2	Frequency <50% OR C/A <2	Frequency =0
Occurrence of Species within Target Map Unit	Frequency ≥50% AND C/A ≥2	Uninformative	Positive diagnostic	Positive diagnostic
	Frequency <50% OR C/A <2	Negative diagnostic	Uninformative	Positive diagnostic
	Frequency =0	Negative diagnostic	Uninformative	-

* C/A = Cover abundance

2.11 REGIONAL VEGETATION DATA COMPARISON

Comparison with site data collected from adjoining areas was completed in two steps. Site data from the Cumberland Plain and Royal National Park supported identical 7 point abundance scores and were

analysed directly with data collected for this project. Systematic data sourced from the Lower Hunter and Central Coast, Metropolitan and Woronora Catchments and Dharawal State Conservation Area utilised a similar though slightly different 6 point abundance score. As a result data from Royal National Park and the Study Area were transformed into a matching scoring system. Several different analyses were performed that compared

- This study and Royal National Park (Raw 7 point scores)
- This study, Royal National Park and the Woronora Plateau (Transformed 6 point scores)
- This study and the Cumberland Plain, Western Sydney (raw 7 point scores)
- This study, Royal National Park, Woronora Plateau and the Lower Hunter and Central Coast (Transformed 6 point scores)

Identical analytical techniques were used on the raw and transposed regional data. Final analysis was based on the Bray-Curtis Measure of dissimilarity using a transformed 6 point abundance score. The robustness of site groups used to define vegetation communities in the Study Area were examined in response to the addition of new sites. Sites that grouped with the original classification at less than the 0.9 level of dissimilarity were said to be similar vegetation communities. Sites that grouped above this level were considered dissimilar.

The South Coast Region (NPWS, 2000a) represents an area extending from Shellharbour in the north to Narooma in the South. The Sydney Basin Bio region overlaps with the northern third of this region north from Ulladulla. Commensurate systematic site data is sparse within this area. As a consequence qualitative comparisons were made with vegetation community descriptions and mapping available for the Shellharbour LGA (Mills, 2000) and for the South Coast Region (NPWS, 2000a).

2.12 MAPPING VEGETATION COMMUNITIES

The extant distribution of vegetation communities has been mapped using a combination of air photo patterns, geology, elevation and aspect. Field site data was used to identify relationships between environmental variables and defined vegetation communities. Existing studies of the habitat characteristics of similarly described communities (Benson & Howell, 1994; Mills & Jakeman, 1995; NCC, 1999; Chafer, 1997; Keith, 1994; NPWS, 2000c) were used to support and confirm patterns found during this survey.

Vegetation types identified from air photo pattern were allocated Vegetation Community Names sequentially using features of highest reliability to lowest. Initially, vegetation features that present high contrast air photo patterns (swamps, rainforest, heath) were mapped. Field data, geology and landscape position variables were used to confirm the air photo type code. Eucalypt dominated vegetation communities were mapped similarly, assigning Map Unit names to Air Photo types of highest interpreter reliability (Classes 1 and 2). Remaining polygons were resolved using field data, geology and adjoining vegetation community patterns.

Coastline estuarine and alluvial environments have not been well sampled. Air Photo Types were used directly to assign Map Unit names for these types.

2.13 CONSERVATION STATUS

2.13.1 Reservation and Land Use Zoning Status

The Reservation and Land Use Zoning Status of each Vegetation Community was examined by overlaying available digital land use zoning information on the derived vegetation map for the Study Area. Accurate tenure layers identified the boundaries of National Park Estate, Water Catchment areas and Council Reserves. These data layers were sourced from NPWS, Sydney Catchments Authority and Wollongong City Council. Table 2.6 describes how individual land use zoning categories were amalgamated to indicate broad land use classes in the Wollongong LGA. Map 3 illustrates the broad land use zones of the Study Area. Map 4 indicates the areas and tenures used to compile the assessment of reserved tenures.

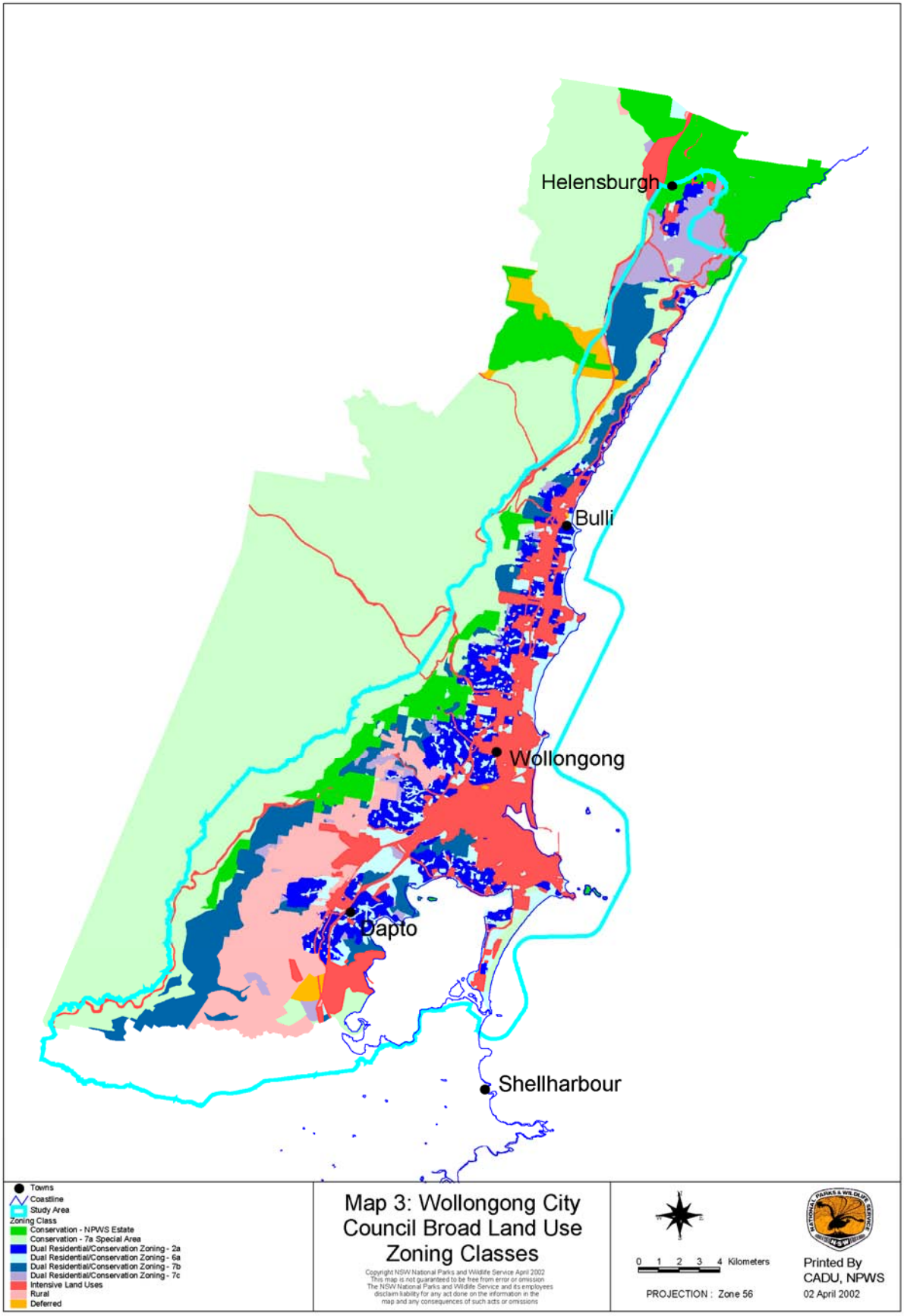
TABLE 2.6: AMALGAMATION OF WOLLONGONG LGA LAND USE ZONINGS TO BROAD LAND USE CLASSES

Intensive Land Uses	Rural	Conservation Zonings		Dual Residential/Conservation Zonings				Deferred
(2b,2c,3a,3b,3c,9a,9b,9c,9d,4a,4b,4c,5b,5c)	1a	NPWS Estate	7(a) Special Area	7(b)	6a, 6b	7c, 7c1,7d	2a,2a1	

Regional Reservation Status was examined by overlaying all commensurate vegetation within the Sydney Basin Bioregion against existing NPWS Estate boundaries. The IBRA Sydney Basin Bioregion Mapping sourced vegetation maps from Royal National Park (NPWS, in prep.), the Lower Hunter and Central Coast (NPWS, 2000b), Western Sydney (NPWS, 2000d), and Mills (2000) and NPWS (2000a) for the South Coast Region. Regional Reservation Status refers to the proportion of the current extent of each vegetation community located within NPWS Estate. This figure does not account for the amount of vegetation lost through clearing, and as a result may seriously underestimate the proportion of the pre-European distribution that is currently within reserves. Vegetation Communities were grouped into three different classes, each of which reflects the proportion of the vegetation community (Class 1 <5%, Class 2 5%-15% and Class 3 15%-30%) within conservation reserves. Similarly, when calculating the zonings of each vegetation community, only the remaining vegetation is used in the calculation.

2.13.2 Disturbance Assessment

The relative condition of each Vegetation Community was examined using the gross disturbance index mapped during the aerial photo interpretation phase. The proportion of each disturbance intensity class was generated against the total area of each community. These proportions and the area (hectare) figures have been included within each vegetation profile. Heavy Disturbance Classes were identified by amalgamating Class C 'Heavy Disturbance' and the Tx 'Scattered Trees' code strings.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Bulli
Wollongong
Dapto
Shellharbour
Towns
Coastline
Study Area
Zoning Class
Conservation - NPWS Estate
Conservation - 7a Special Area
Dual Residential/Conservation Zoning - 2a
Dual Residential/Conservation Zoning - 6a
Dual Residential/Conservation Zoning - 7b
Dual Residential/Conservation Zoning - 7c
Intensive Land Uses
Rural
Deferred
Map 3: Wollongong City Council Broad Land Use Zoning Classes
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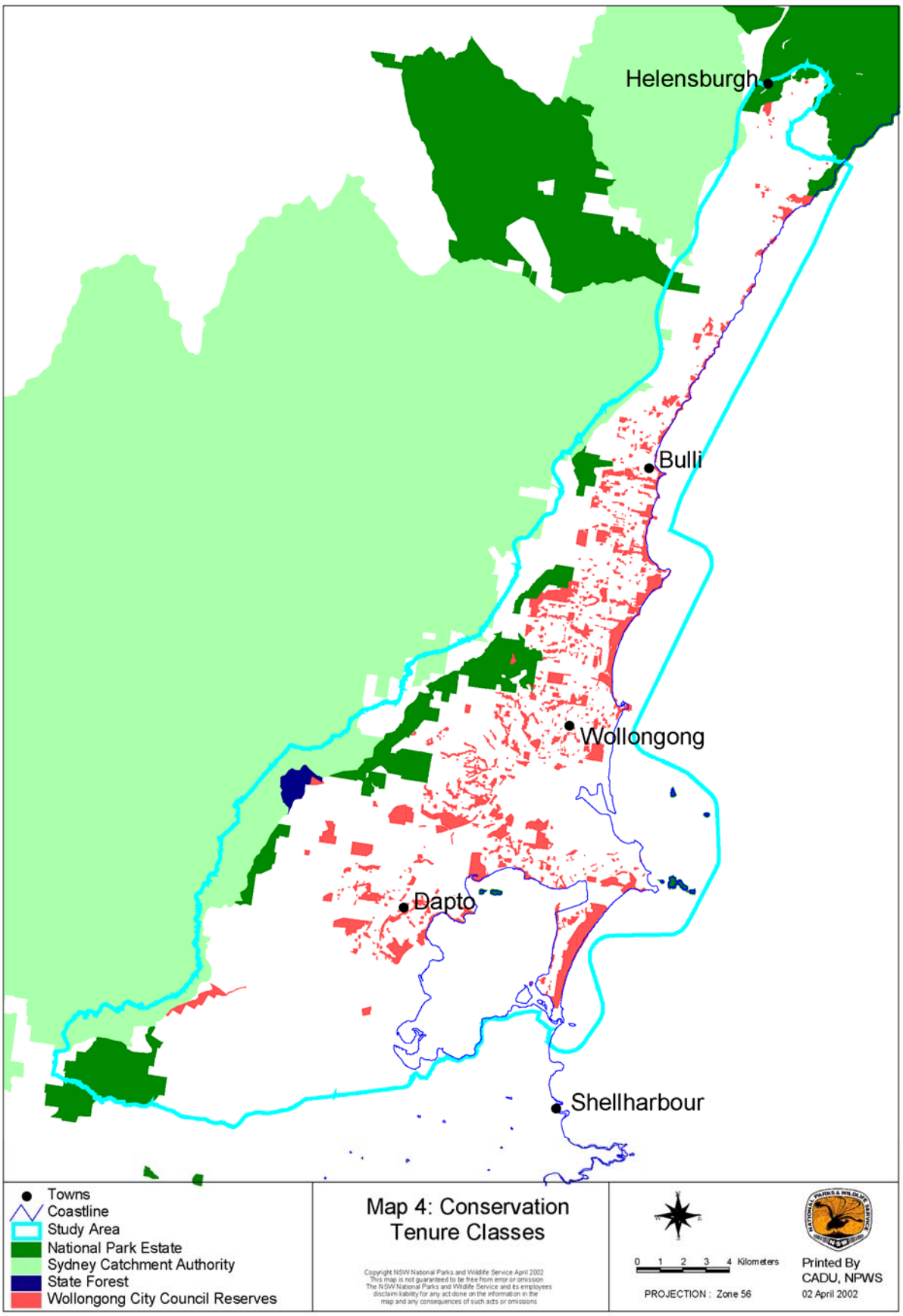
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Bulli
Wollongong
Dapto
Shellharbour
Towns
Coastline
Study Area
National Park Estate
Sydney Catchment Authority
State Forest
Wollongong City Council Reserves
Map 4: Conservation Tenure Classes
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3 RESULTS

3.1 FIELD SURVEY

A total of 191 sites were completed across a range of environments and land tenures. A map showing the locations of all sites completed in the LGA is presented in Map 5. A summary of sites achieved against strata units is presented in Appendix B. Over 90 percent of target strata were sampled adequately. A number of strata have been undersampled. This is to be expected as some environments are so heavily cleared that very few remnants remain. Also, some areas of private land could not be sampled where permission to access was not granted. Existing sites available for analysis addressed many of the gaps on poorly sampled strata. These were most notable on Maddens Plains and in the Hawkesbury Sandstones landscapes.

The field survey identified 606 native species. A further 108 introduced species were recorded. New locations of *Cynanchum elegans*, a species listed as Endangered on the NSW Threatened Species Act (1995) were obtained during the survey.

3.2 AERIAL PHOTO INTERPRETATION

Over 100 different landscape features have been mapped. These include vegetation patterns and physical and structural attributes. Interpretation was completed across 48,620 hectares. Individual mapping polygon size ranged from 0.03 hectares to over 4000 ha. A total of 10,616 polygons were mapped.

3.2.1 Spatial Accuracy

The spatial accuracy of the API data layer is based on a detailed comparison of 100 polygons against linear and high contrast landscape features obvious in the orthorectified 1994 LPI air photo images for the Study Area.

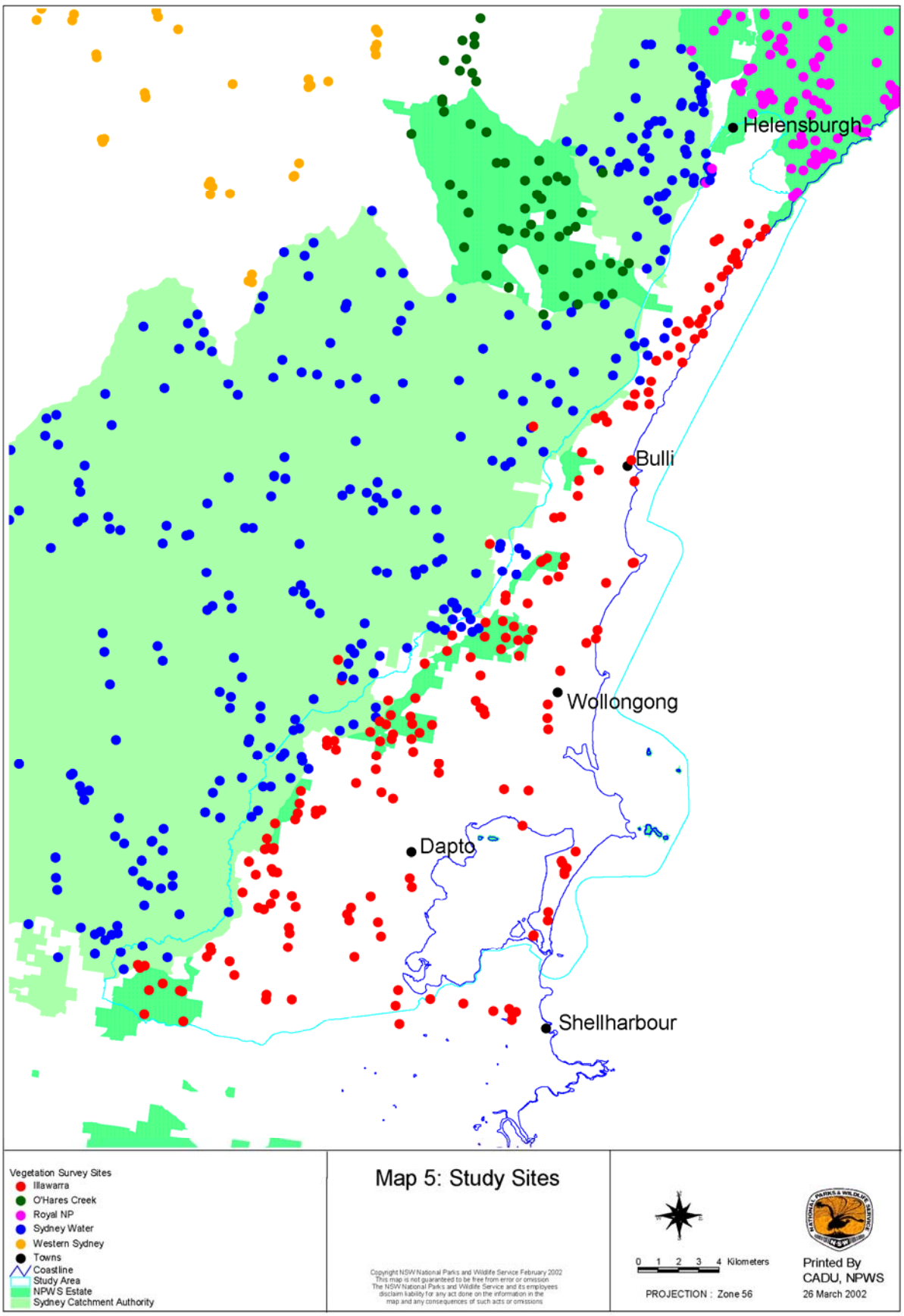
- 93 percent were found to be within a tolerance of 24 metres. Spatial Accuracy is best on flat to undulating topography of the coastal plains and worst on the steep escarpment slopes where displacement from air photos is greatest.
- Highest displacement reached 70m on steep escarpment slopes above the Calderwood Valley and near escarpment benches in the Scarborough-Wombarra-Stanwell Park areas.
- Coding transfer error between photo and coverage is less than one percent, based on comparison between one hundred sample codes.

3.2.2 Vegetation Cover

A total of 14669 hectares were identified as native vegetation cover greater than 0.5 hectares in size. This comprises 30.9 percent of the Study Area. Table 3.1 below indicates the proportion of mapping features found in the Study Area. Map 6 shows the area supporting native vegetation cover within the Study Area.

TABLE 3.1: BROAD API MAPPING FEATURES

Broad Mapping Feature	Area (ha)	Proportion of Study Area (%)
Native Vegetation Cover >0.5 hectares	14668.95	30.9
Cleared, Urban or Exotic Vegetation	19564.59	41.2
Scattered Native Trees	1211.34	2.6
Water Bodies	426.64	0.9
Ocean and Lake Illawarra	10227.34	21.6
Seagrass and mudflats	889.27	1.9
Rocks, Cliffs, etc.	316.53	0.7
Total	47304.66	100


Helensburgh
Bulli
Wollongong
Dapto
Shellharbour
Vegetation Survey Sites
Illawarra
O'Hares Creek
Royal NP
Sydney Water
Western Sydney
Towns
Coastline
Study Area
NPWS Estate
Sydney Catchment Authority
Map 5: Study Sites
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0 1 2 3 4 Kilometers
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3.2.3 Interpretation Reliability

The classes describing the confidence in the interpretation of the landscape features are shown in Map 7. Over 90 percent of the Study Area demonstrates a high level of mapping confidence based on either the visitation of sites or the extrapolation of patterns based on visited areas. Lower confidence levels were used in areas that presented unique photo patterns to the interpreter. In most instances these arose in areas that were inaccessible.

3.3 VEGETATION CLASSIFICATION

The Dendrogram highlighted four broad groups of sites from which 35 vegetation communities were identified. A simplified Dendrogram is presented in Figure 3.2. A further three communities were resolved on the basis of structure (Coastal Headland Banksia Scrub), substrate (Hind-Dune Littoral Rainforest) and the dominance of a unique tree species (Spotted Gum Open Forest).

The first of the four major groups describe vegetation communities of the coastal plain and adjacent lowland slopes. Two variants of the Coastal Grassy Red Gum Forest are present. These delineate minor splits based on the occurrence of *Melaleuca styphelioides* in the subcanopy.

The second group illustrates those communities that are either strongly influenced by proximity to the coast or those that support a grassy understorey. Vegetation on the coastal sand dune complex are well defined. The cluster of littoral vegetation is less well defined. Littoral rainforest types are presented here as a complex. However, they have been split between rainforest occurring on sand to those of the clay soils on headlands. Littoral rainforest on sand is virtually all cleared from the Wollongong LGA and remnants are highly degraded. The Bangalay-Banksia Complex describes two map units that contain many similar species. Coastal Headland Banksia Scrub and Exposed Bangalay-Banksia Woodland represent a structural gradient rather than a floristic variation. Escarpment Blackbutt Forest includes one site describing the Spotted Gum Open Forest community. This split has been made on the basis of the uniqueness of the canopy species to the Study Area and the highly degraded condition of the two remnant patches.

The third broad cluster of sites comprises a diverse group of wetland and swamp communities as well as typical sandstone vegetation of the Woronora plateau. Coastal Swamp Oak Forest includes a site that describes Estuarine Alluvial Reedland, a split that reflects an obvious structural variation of the community.

The final group assembles the combination of wet sclerophyll forests and rainforests of the escarpment and its foothills.

A number of additional communities are not described by the dendrogram. Quantitative data from surveys undertaken by SCA was used to describe the vegetation occurring on Sheltered Hawkesbury Sandstones, Rocky Outcrops and the Upland Swamp complexes. Riparian River Oak Forest, Floodplain Wetlands and Seagrass were not sampled during this project and have been described from existing resources and informal observations. Full descriptions of each vegetation community are presented in Appendix A.

3.4 MAPPING EXTANT VEGETATION COMMUNITIES

A total of 62 landscape features have been mapped. Native vegetation communities are described and mapped by 54 Map Units. Table 3.2 indicates the total area of each Map Unit found within the Study Area. Map 8 shows the distribution of the Vegetation Communities in the Study Area.

TABLE 3.2: MAP UNITS WITH EXTANT AREA (HECTARES) WITHIN STUDY AREA

MAP UNIT	VEGETATION COMMUNITY NAME	Area (ha)
MU1	Illawarra Escarpment Subtropical Rainforest	286.17
MU2	Coachwood Warm Temperate Rainforest	2293.95
MU3	Robertson Cool-Warm Temperate Rainforest	11.13
MU4	Lowland Dry-Subtropical Rainforest	461.12
MU5	Littoral Windshear Thicket	69.21
MU6	Hind-Dune Littoral Rainforest	1.89

MAP UNIT	VEGETATION COMMUNITY NAME	Area (ha)
MU7	Cliffline Coachwood Scrub	54.09
MU8	Escarpment Moist Blue Gum Forest	608.02
MU9	Moist Coastal White Box Forest	679.33
MU10	Moist Gully Gum Forest	1074.17
MU11	Moist Blue Gum-Blackbutt Forest	280.72
MU12	Moist Brown Barrel Forest	98.70
MU13	Moist Box-Red Gum Foothills Forest	620.09
MU14	Robertson Basalt Brown Barrel Forest	3.75
MU15	Moist Shale Messmate Forest	88.18
MU16	Escarpment Blackbutt Forest	1833.51
MU17	Tall Open Gully Gum Forest	411.50
MU18	Tall Open Peppermint-Blue Gum Forest	119.11
MU19	Tall Open Blackbutt Forest	142.49
MU20	Tall Blackbutt-Apple Shale Forest	163.01
MU21	O'Hares Creek Shale Forest	2.67
MU22	Highlands Shale Tall Open Forest	27.61
MU23	Coastal Grassy Red Gum Forest	797.44
MU24	Lowland Woollybutt-*Melaleuca* Forest	474.19
MU25	Spotted Gum Open Forest	26.89
MU26	Escarpment Edge Silvertop Ash Forest	620.69
MU27	Silvertop Ash Ironstone Woodland	82.03
MU28	Sandstone Gully Apple-Peppermint Forest	494.90
MU29	Sandstone Gully Peppermint Forest	469.75
MU30	Exposed Sandstone Scribbly Gum Woodland	1551.41
MU31	Nepean Enriched Sandstone Woodland	17.89
MU32	Exposed Bangalay-Banksia Woodland	148.30
MU33	Coastal Sand Bangalay-Blackbutt Forest	28.45
MU34	Coastal Sand Swamp Mahogany Forest	12.41
MU35	Alluvial Swamp Mahogany Forest	35.46
MU36	Coastal Swamp Oak Forest	241.35
MU37	Riparian River Oak Forest	104.62
MU38	Highlands Swamp Gum-*Melaleuca* Woodland	10.74
MU39	Coastal Sand Freshwater Wetland	3.33
MU40	Upland Swamps: Tea-tree Thicket	29.49
MU41	Upland Swamps: Banksia Thicket	139.45
MU42	Upland Swamps: Sedgeland-Heath Complex	537.74
MU43	Upland Swamps: Fringing Eucalypt Woodland	46.88
MU44	Upland Swamps: Mallee-Heath	57.26
MU45	Coastal Sand Scrub	256.69
MU46	Coastal Headland Banksia Scrub	54.97

MAP UNIT	VEGETATION COMMUNITY NAME	Area (ha)
MU47	Budawang Ash Mallee Scrub	10.60
MU48	Rock Pavement Heath	1.76
MU49	Rock Plate Heath-Mallee	70.31
MU50	Beach Sands Spinifex	25.33
MU51	Coastal Headland Grasslands	23.09
MU52	Saltmarsh	48.24
MU53	Estuarine Alluvial Wetlands	35.03
MU54	Floodplain Wetlands	111.62
55a	Seagrass Meadows and Estuarine Flats	790.52
55b	Offshore Mixed Reef	98.75
56a	Acacia Scrub	1227.95
56b	Turpentine Regeneration	92.59
56c	*Allocasuarina* Heath Regeneration	0.66
56c	Weeds and Exotics	1645.61
56d	Cleared	17497.83
56e	Modified Lands	421.15
57a	Artificial Wetlands	170.18
57b	Beach Sand	171.67
57c	Coastal Rock Platforms	124.96
57d	Land Slip	16.24
57e	Estuarine Lagoons and Channels	256.46
57f	Fig Trees	11.56
57g	Rock Outcrops	3.66
57h	Submerged Rock Platforms	1543.05
57i	Water	8684.30

3.5 REGIONAL VEGETATION COMMUNITY COMPARISON

3.5.1 The Central Coast and Hunter Ranges

The Central Coast and Lower Hunter Valley represents a province within the Sydney Basin Bioregion that shares some similarities in climate, landform and coastal location. The Watagan Ranges provide the dominant influence on the climatic variation with rainfall levels similar to that found in Wollongong. However, the range itself is set back much further from the coast and as a result the maritime influence is weaker and temperatures are cooler. Vegetation communities of the Watagan Ranges are similarly dominated by wet sclerophyll forests and warm temperate rainforests and include some conspicuous species shared between communities of both provinces. However, the floristic relationship between the wet sclerophyll forests and rainforests of Wollongong and the Watagan Ranges was found to be poor. Wet forests in the Central Coast are dominated by Blue Gums (*Eucalyptus saligna* and *Eucalyptus deanei* - the latter species not found in Wollongong) with a warm temperate rainforest understorey. Forests of similar appearance in Wollongong share an equivalent structure. However, the rainforest subcanopy supports a greater influence of Subtropical Rainforest including *Diploglottis australis, Toona australis* and *Dendrocnide excelsa*. Interestingly, the Wet Blue Gum Forests found in narrow ribbons in the Royal National Park were found to have greater similarities to forests of the Central Coast than those of the Wollongong escarpment benches. Blackbutt Forests in the two provinces demonstrated superficial similarities, but were also marked by clearly different species composition. The Watagan Ranges appear to support greater sandstone influence, with species such as *Persoonia linearis* and *Podolobium*

ilicifolium frequently recorded in the shrub layer. These are not found in Escarpment Blackbutt Forest on the Wollongong escarpment. The Watagan Ranges also appears to more closely mark the southern end of north coast forests with Eucalypts such as *Eucalyptus acmenoides, E. microcorys, E. punctata* and *E. umbra*. Such differences also help explain why the Spotted Gum Forest groups are also dissimilar. Existing literature (Floyd, 1990) describing a consistent Coachwood Warm Temperate Rainforest between both the Illawarra and the Watagan Ranges is not supported by the analyses of site data.

The vegetation of the coastal plain of the Central Coast region also has little in common with the communities of the Wollongong plain. While vegetation communities dominated by *Eucalyptus tereticornis* occur in both provinces, they have different associated Eucalypt and *Melaleuca* species. This is most pronounced in a community at the footslopes of Watagan Ranges in Wyong. Bell (in prep.) has identified a community described as Woollybutt *Melaleuca* Sedge Forest that shares some similarities with Lowland Woollybutt-*Melaleuca* Forest found near Yallah. However, *Melaleuca nodosa* is the dominant paperbark in the Wyong community, with a greater abundance of species of the Juncaceae family occurring on the periodically waterlogged soils.

Greater similarities were found between the two provinces when sites from the respective coastline zones were analysed. Sites describing Coastal Sand Freshwater Wetland were closely grouped to similar wetlands on sand deposits found at Tacoma, near Wyong. The single sample describing Alluvial Swamp Mahogany Forest on the Wollongong plain grouped with sites describing moist Swamp Mahogany assemblages found on coastal alluvium at Gosford and Wyong although *Melaleuca quinquenervia* is noticeably absent from the Wollongong Study Area. The vegetation communities on the coastal sand dunes shared large numbers of species for the Coastal Sand Scrubs although communities were different on the higher more established dunes. *Eucalyptus botryoides* is not prominent on sand complexes of the Central Coast.

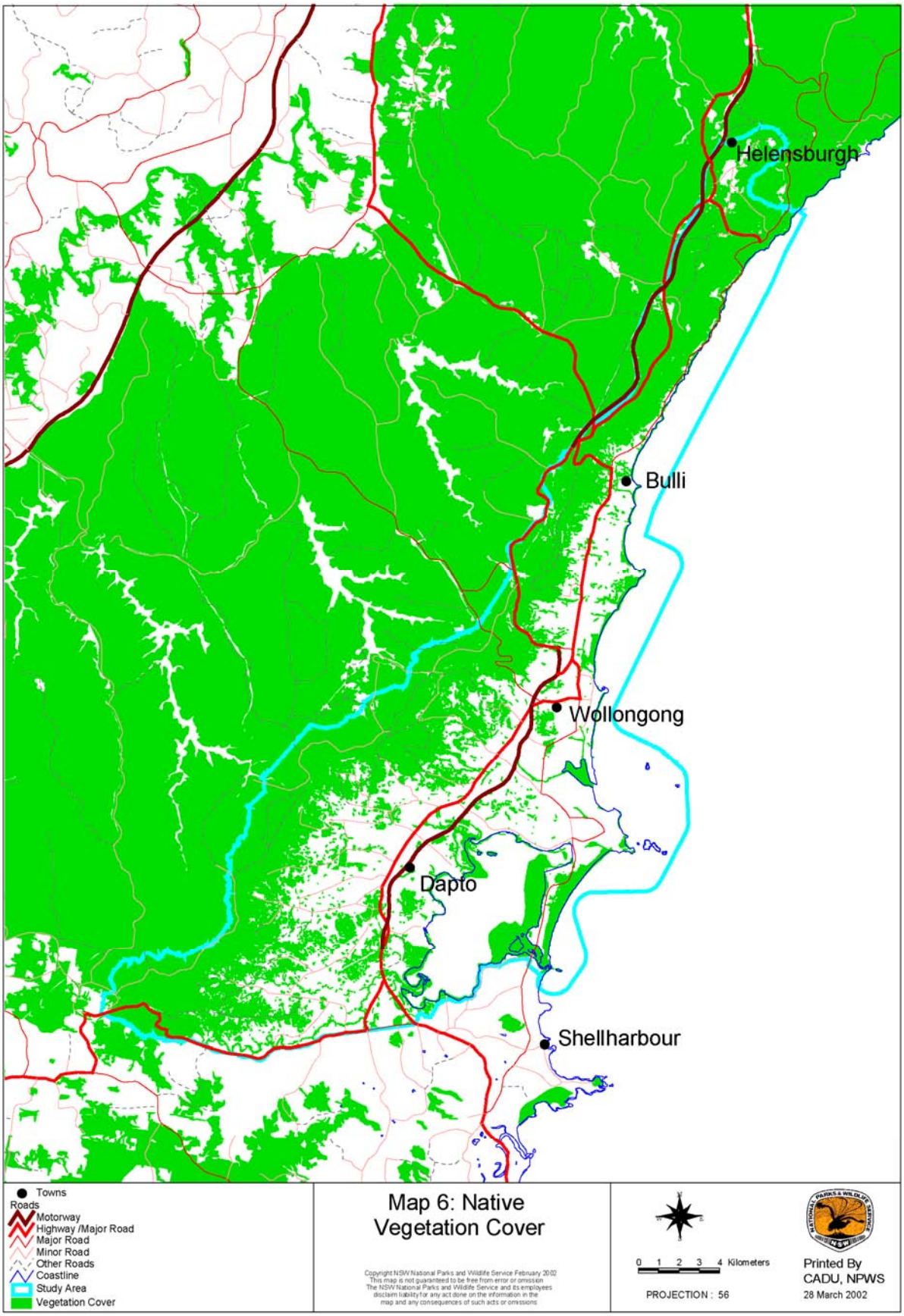
3.5.2 Western Sydney and the Cumberland Plain

The Cumberland Plain is an expanse of shale derived soils that occur across the undulating countryside of Western Sydney. While a coastal plain in landform, its climatic characteristics are different to those of the Illawarra plain. Rainfall is lower with mean average records varying between 650 mm per year in the west of the Cumberland Plain, to 900mm per year east of Parramatta. Mean annual temperatures are also cooler given the relative distance from the coast.

The Cumberland Plain supports remnants of once expansive grassy woodlands dominated by *Eucalyptus tereticornis* and *E. moluccana*. Structurally these woodlands share a similarity with those on the Illawarra coastal plain. However, the two appear poorly related based on the species composition of respective site data. The initial differences are identified by the absence of *Eucalyptus moluccana*, *E. crebra* and *E. fibrosa* in Wollongong, with these species described as abundant in Western Sydney (NPWS, 2000b). *Eucalyptus bosistoana* is the prominent box eucalypt found on the Illawarra coastal plain. *Bursaria spinosa* is a prominent shrub species in Western Sydney that is found only infrequently in the Illawarra. The grass cover share several dominant species including *Themeda australis* and *Microlaena stipoides* var. *stipoides* although *Poa labillardieri* var. *labillardieri* is prominent on the Illawarra Plain and not the Cumberland Plain. Acacia species also vary, with *Acacia implexa* found more commonly on the latter and *A. maidenii* on the former.

Western Sydney also supports a depauperate dry rainforest compared to that found on the Illawarra Lowlands and Foothills. Some species are again shared between these rainforests, though sites describing dry rainforest in Western Sydney failed to group at all with those describing either Lowland Dry-Subtropical rainforest or Moist Box-Red Gum Foothills Forest of the Wollongong Study Area. A large number of rainforest species found in the Wollongong communities are not recorded at sites describing Western Sydney Dry Rainforest. Examples of these include *Ficus* spp., *Geijera salicifolia* var. *salicifolia* and *Cassine australis* var. *australis.*

On the North Shore of Sydney, remnants of Blue Gum High Forest persist on shale soils marked by mean annual rainfall levels greater than 1100 mm per year. These forests, dominated by *Eucalyptus saligna* and *E. pilularis* bear little resemblance to the Moist Blue Gum Forests of the Wollongong escarpment, with the abundant and luxuriant rainforest subcanopy noticeably absent from the Sydney forests.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Towns
Roads
Motorway
Highway /Major Road
Major Road
Minor Road
Other Roads
Coastline
Study Area
Vegetation Cover
Map 6: Native Vegetation Cover
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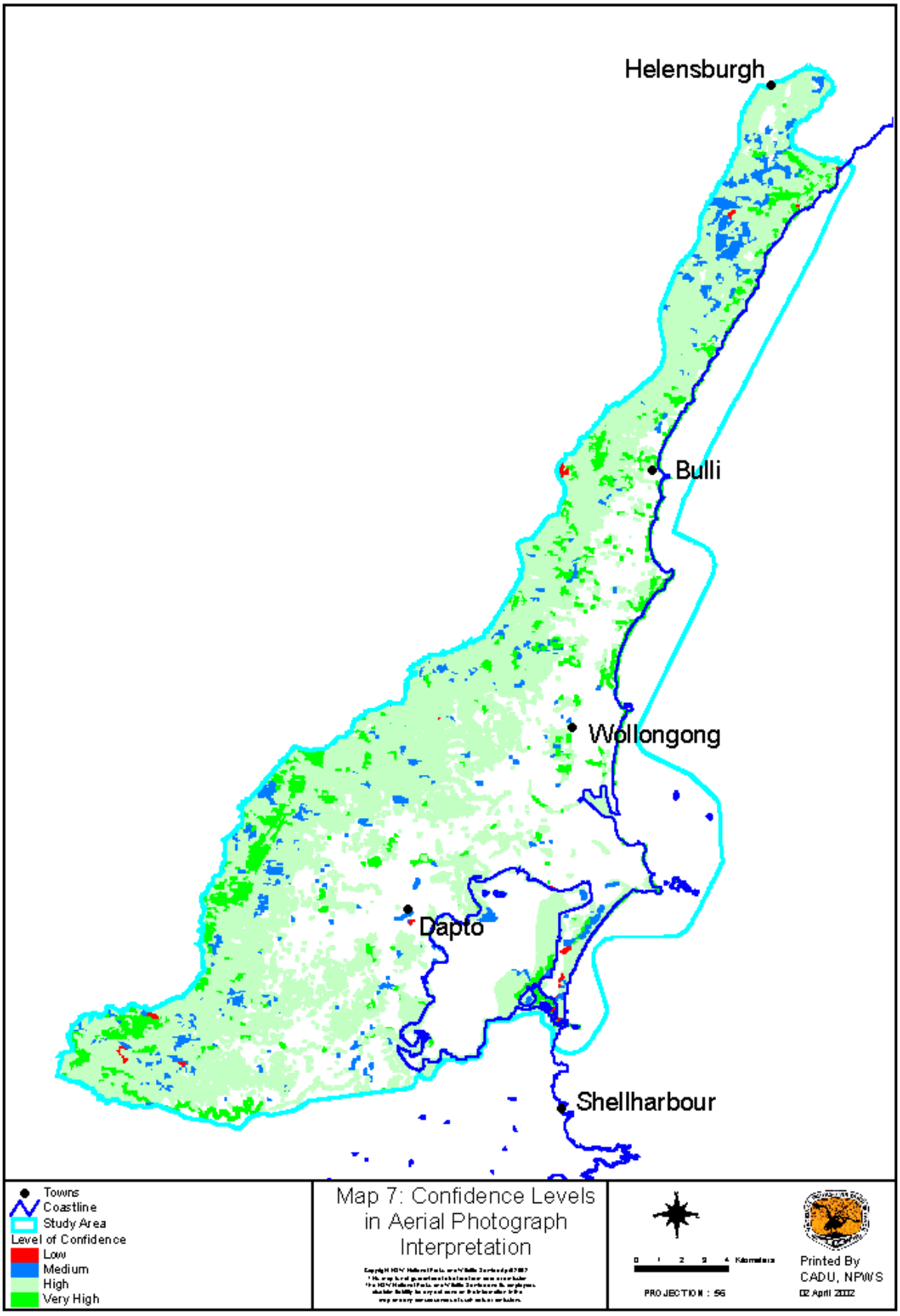
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Wollongong
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Shellharbour
Towns
Coastline
Study Area
Level of Confidence
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Medium
High
Very High
Map 7: Confidence Levels in Aerial Photograph Interpretation
PROJECTION : 56
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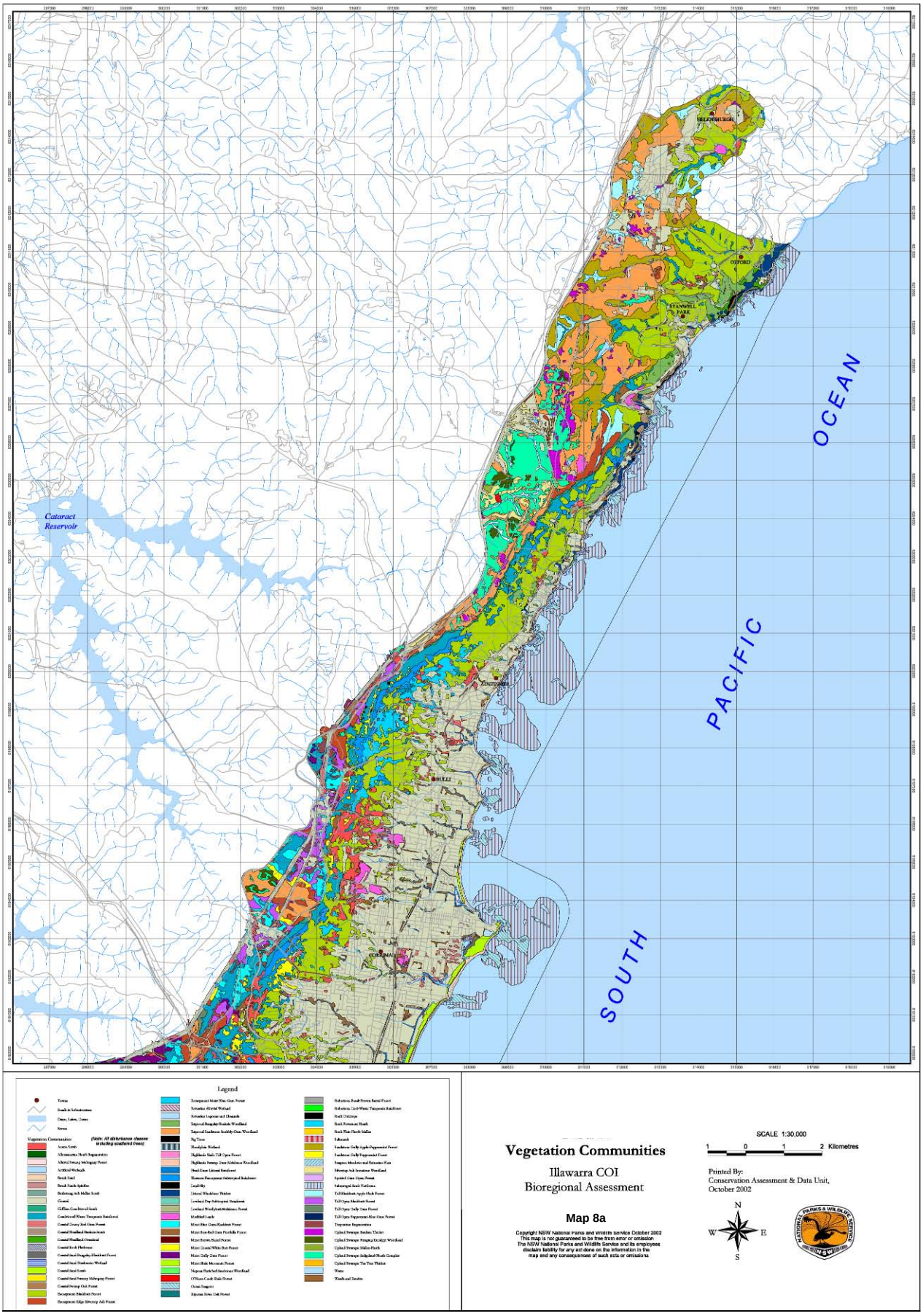
02 April 2002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BULLI
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Illawarra COI
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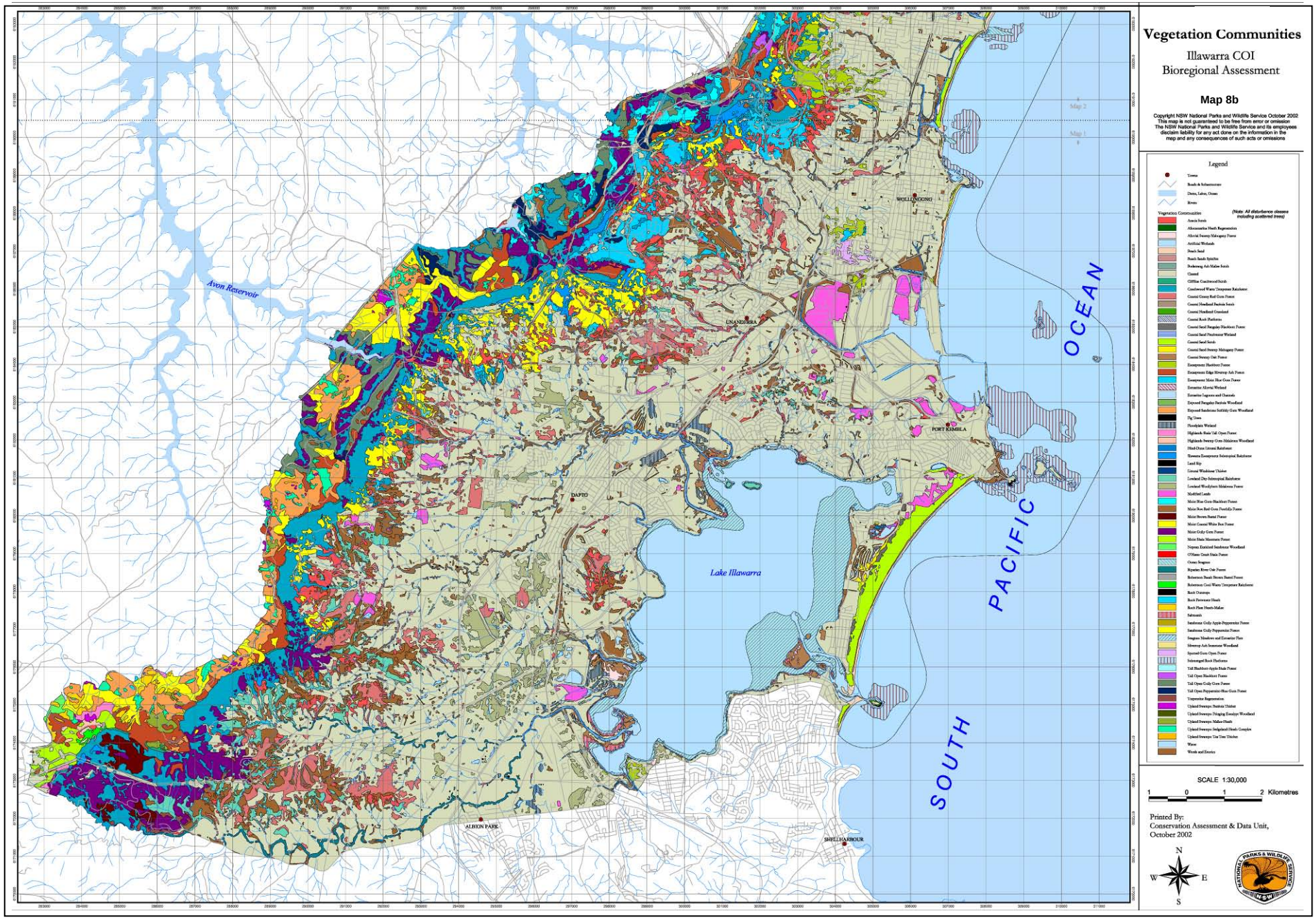
Vegetation Communities
Illawarra COI
Bioregional Assessment
Map 8b
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disclaim liability for any act done on the information in the
map and any consequences of such acts or omissions
Legend
Towns
Roads & Infrastructure
Dams, Lakes, Ocean
Rivers
Vegetation Communities
(Note: All disturbance classes including scattered trees)
Avon Reservoir
WOLLONGONG
UNANDERRA
PORT KEMBLA
DAPTO
Lake Illawarra
ALBION PARK
SHELLHARBOUR
PACIFIC OCEAN
SOUTH
SCALE 1:30,000
1 0 1 2 Kilometres
Printed By:
Conservation Assessment & Data Unit,
October 2002
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NATIONAL PARKS & WILDLIFE SERVICE NSW

Legend for map 8

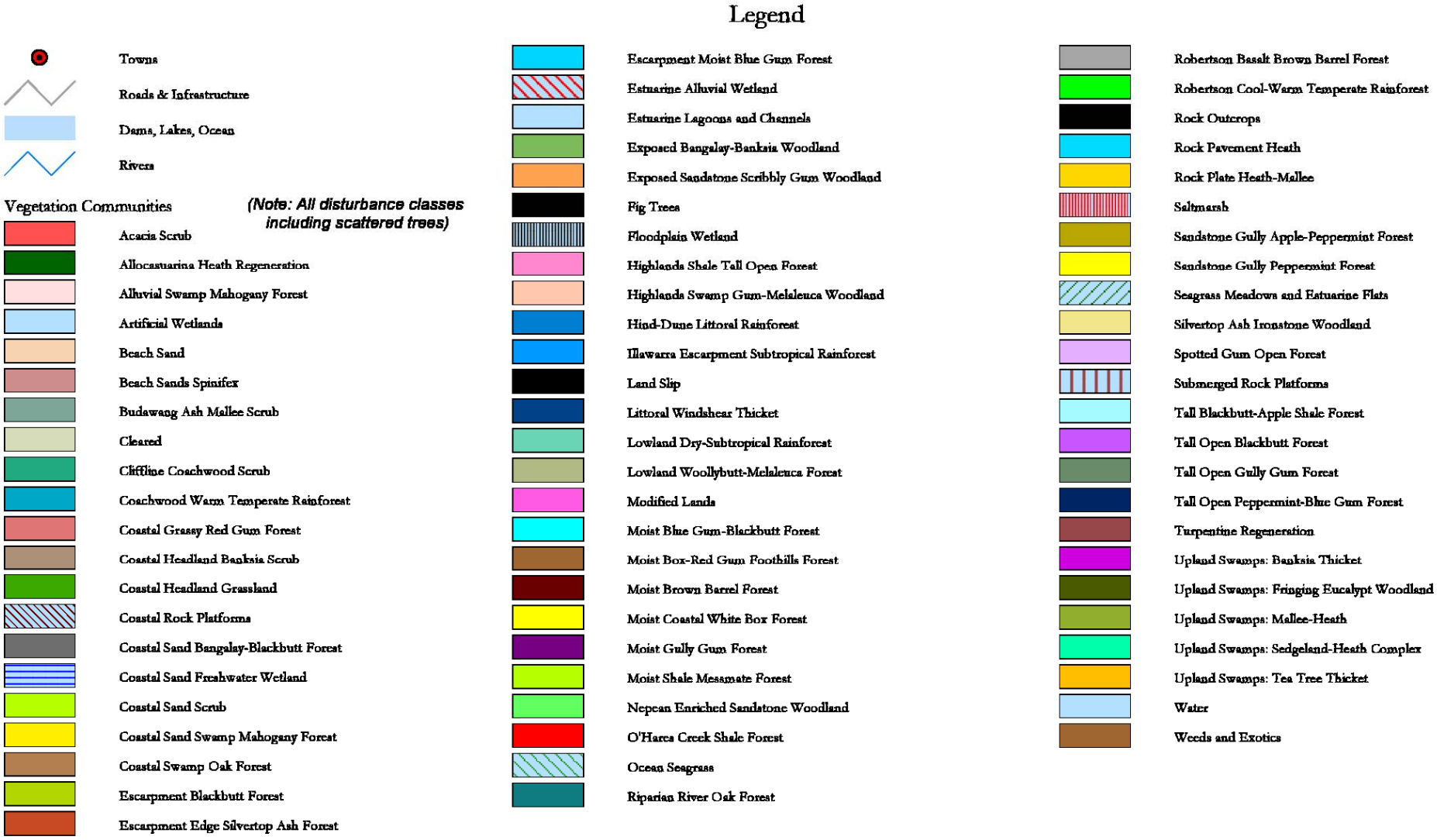
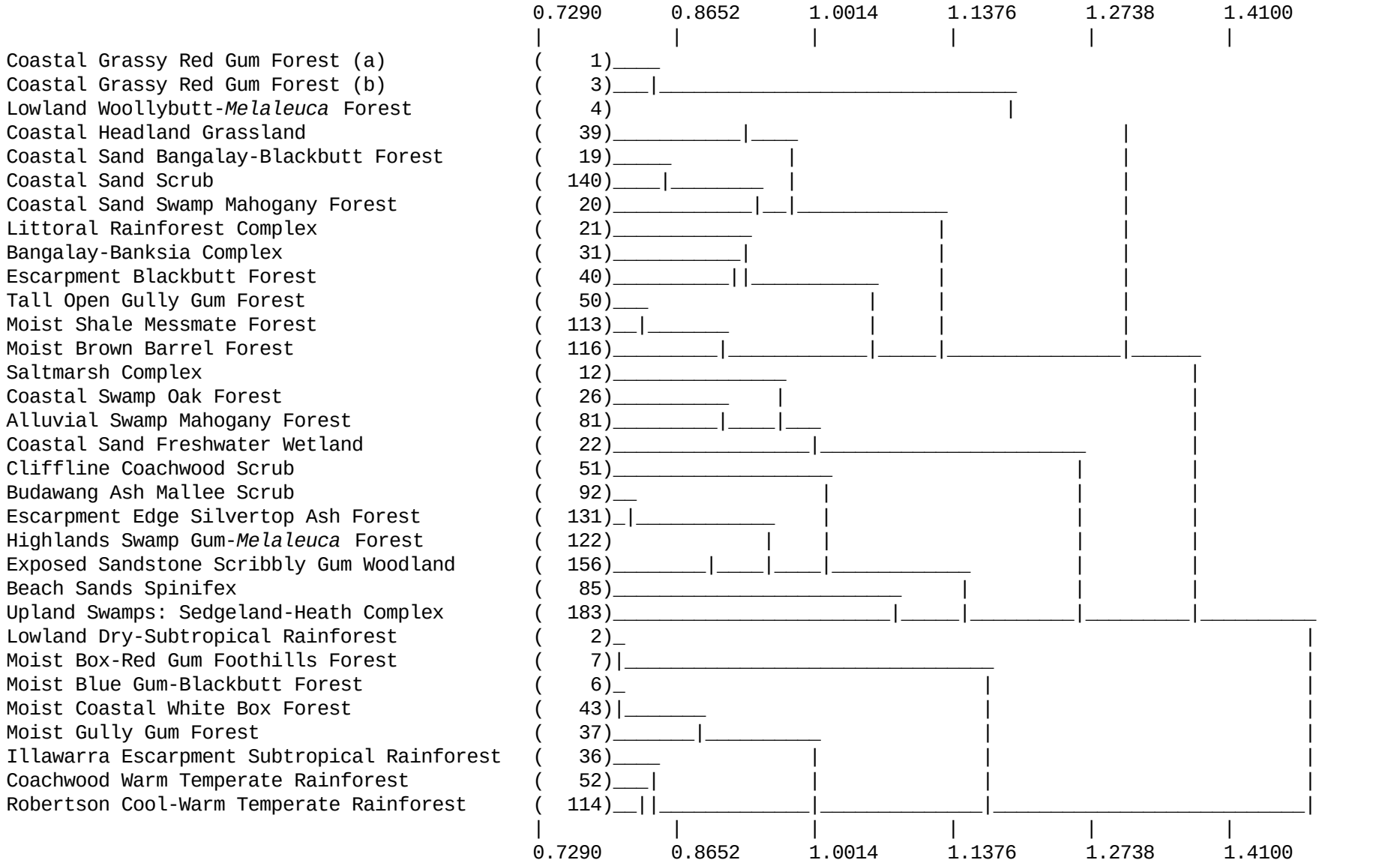


FIGURE 3.2 SIMPLIFIED DENDROGRAM SHOWING HIERACHIAL STRUCTURE OF NATIVE VEGETATION COMMUNITIES IDENTIFIED FROM SITE DATA



3.5.3 Royal National Park

Royal National Park occupies a large portion of the northern Wollongong LGA. The Park is primarily comprised of a Hawkesbury Sandstone Plateau and deeply eroded Narrabeen Sandstone gullies. However, because of its coastal location it represents a continuation of many of the vegetation communities found in the northern half of the Study Area. Analysis of relevant site data found that there were strong similarities between many of the coastal clay headland communities. These included Littoral Windshear Thicket, Coastal Headland Grassland, Coastal Headland Banksia Scrub, Exposed Bangalay-Banksia Woodland and Escarpment Blackbutt Forest. Similarities were also revealed between rainforest sites in the Park and those describing Coachwood Warm Temperate Rainforests and Illawarra Escarpment Subtropical Rainforests. The latter is highly restricted to only a few localities within the Park. Samples from coastal wetlands at Bundeena Swamp and Korrungulla Wetland also shared a similar floristic composition.

3.5.4 South Coast Region

Qualitative comparisons between vegetation communities are a less robust method of equating communities as they rely on partial descriptions of the vegetation present and do not develop an understanding of the frequency and abundance at which each species occurs. While information of this type is presented in NPWS (2000a) it is noted that site data is relatively sparse between Wollongong and the Shoalhaven and descriptions may reflect species composition that are more accurate for the south of the region than they are for the north.

Nevertheless, Mills (2000) provides sufficient information to conclude that many of the communities of the coastal plain and escarpment foothills are likely to extend into Shellharbour and Kiama LGAs. Vegetation of the Coastline Zone in the Study Area appears to share some similarities with those of the Southern Region. Marine Sand Deposits found at Windang which support Coastal Sand Bangalay-Blackbutt Forest, Coastal Sand Swamp Mahogany, Coastal Sand Scrub and Hind-Dune Littoral Rainforest lend to comparison with Forest Ecosystems described in NPWS (2000a) that occupy similar coastal sand habitats. All except Coastal Sand Swamp Mahogany occur in the Shellharbour LGA and are given similar vegetation community titles in Mills (2000). Both freshwater and saltwater wetland complexes support identical dominant species.

Similar patterns also emerge for vegetation communities found on the coastal plain and foothills of the southern portion of the Study Area. A number of sites completed in Shellharbour LGA indicate that Lowland Woollybutt-*Melaleuca* Forest and Coastal Grassy Red Gum Forest extend south of the Study Area. Riparian forests including Riparian River Oak Forest and Coastal Swamp Oak Forest are also prominent forests in both the Shellharbour LGA and the South Coast Region. Moist Box-Red Gum Foothills Forest and Lowland Dry-Subtropical Rainforest occur on the Shellharbour footslopes.

The Wet Sclerophyll and Rainforests of the escarpment slopes are also present in the Shellharbour LGA. Moist Gully Gum Forest, Moist Coastal White Box Forest, Moist Brown Barrel Forest and Coachwood Warm Temperate Rainforest all are likely to form part of the southern extension of the escarpment forests south of Mt. Kembla. However, the presence of Wet Sclerophyll Forests that support a distinctive rainforest subcanopy containing subtropical rainforest species are not noted by either NPWS (2000a) or Mills (2000). These forests described here as Moist Coastal White Box Forest and Escarpment Moist Blue Gum Forest occupy the lower to mid escarpment benches and gullies. No commensurate vegetation communities have been described south of Wollongong. This is surprising because the closely affiliated rainforest community Illawarra Escarpment Subtropical Rainforest, which is also a feature of escarpment benches, does occur south of the Study Area, albeit in considerably fewer locations. Mills & Jakeman (1995) note that similar stands of such rainforest are found in the Kangaroo Valley although they are less floristically diverse because temperatures are cooler. Examination of the NPWS (2000a) data indicates that escarpment Blue Gum Forests are extensive on the escarpment south of Barren Grounds Nature Reserve to the Shoalhaven River. Informal observations of these forests have revealed a tall forest that shares the distinctive warm temperate to subtropical rainforest layer underneath a Eucalypt canopy of *E. saligna*, *E. quadrangulata* and *Syncarpia glomulifera* subsp. *glomulifera*. Further survey effort is warranted in these areas to clarify the regional relationships of these moist forest communities.

Escarpment Eucalypt forests in the north of the Study Area, share closer affinities to the vegetation of Royal National Park than to the southern escarpment communities. At lower elevations in Shellharbour

LGA there are isolated examples of Escarpment Blackbutt Forest. However, the Exposed Bangalay-Banksia Woodlands are absent because the escarpment is not as close to the ocean as it is in Wollongong's northern suburbs. This reduces the effect of the salt laden winds on the floristic composition of the vegetation.

The floristic composition of the vegetation of the escarpment cliffs and plateau are united by the nutrient poor soils that underlie them. These soils are derived from the Hawkesbury Sandstone that forms a large component of the geology of the Sydney Basin Bio region. Many of the drier forests and woodlands supporting a heath understorey are closely related to those that occur south of the Study Area (NPWS, 2000a).

The vegetation communities that occur on Wianamatta Shales and Basalt in the Study Area are at their northern and eastern limits. Moist Shale Messmate Forest is an extensively distributed community of the escarpment of the South Coast Region. Robertson Cool-Warm Temperate Rainforest and Robertson Basalt Brown Barrel Forest are more extensive on the adjoining basalt geology of the Robertson Highlands.

3.6 CONSERVATION STATUS

3.6.1 Reservation and Land Use Zoning Status

Sydney Basin Bioregion

The Sydney Bioregion contains an extensive network of large reserves and protected areas. These areas are located across the broad sandstone plateaux that form a ring around the heavily urbanised coastal plains, valleys and ranges. Over 37 percent of the total land area within the Bioregion is located within NPWS Estate.

The estimated regional reservation status of each vegetation community is presented in Table 3.4. This table highlights the proportion of each vegetation community located within NPWS Estate in the Sydney Basin Bioregion. Estimated extant area based on currently available vegetation mapping (see section 2.13) is also presented.

TABLE 3.3: AREA AND PROPORTION OF NATIVE VEGETATION WITHIN THE STUDY AREA AND REGION

Tenure	Total in Study Area (ha)	Proportion of Study Area (%)	Total in Sydney Basin Bioregion (ha)	Total Area as Proportion of Bioregion (%)
National Park Estate	2358.6	14.8	1,371,443	37.7
State Forest	169.3	1.1	179,715	4.9
Water Catchment	2443.2	15.3	102,769	3
Wollongong City Council Reserve	825.5	5.2	N/A	N/A
Other	10179.1	63.6	1,980,407	54.5
Total	15975.7	100	3,634,334	100

TABLE 3.4: DISTRIBUTION OF VEGETATION COMMUNITIES OF THE STUDY AREA IN THE SYDNEY BASIN BIOREGION AND STUDY AREA

	Community Name	Distribution in Sydney Basin Bioregion	Extant Area in Study Area Reserves (ha)	Proportion of Extant Area in Reserves (%)	Estimated Extant Bioregional Area (ha)	Proportion of Extant Area in NPWS Estate or SCA Catchment (%)
1	Illawarra Escarpment Subtropical Rainforest	Limited to mid to upper escarpment slopes, gullies and benches between Royal NP and Shoalhaven River.	157.91	55.2	8114	30
2	Coachwood Warm Temperate Rainforest	South from Royal NP along the length of the Illawarra escarpment and deep gullies of the Avon, Cordeaux and Cataract Catchments.	1069.63	46.6	>5000	42
3	Robertson Cool-Warm Temperate Rainforest	Northern limit at Macquarie Hill. Limited remnants found across the Basalt geologies of the Robertson Plateau. A closely related community exists on Basalt caps in Wollemi and Blue Mountains National Parks.	1.69	15.2	571	9
4	Lowland Dry-Subtropical Rainforest	Restricted to the LGAs of Kiama, Shellharbour and Wollongong.	65.64	14.3	2079	2.5
5	Littoral Windshear Thicket	South from Royal National Park to Jervis Bay.	38.06	55.0	93	59
6	Hind-Dune Littoral Rainforest	Closely related to other littoral rainforests on sand at Wyong and Gosford, extending south to Jervis Bay.	1.55	82.0	1.76	N/A
7	Cliffline Coachwood Scrub	Extends along the length of the escarpment, closely related to the riparian scrubs found along the gullylines of the drier sandstone habitats of Woronora, O'Hares and Cataract catchments. Not well mapped as community occurs only along clifflines.	8.95	16.5	>125	8
8	Escarpment Moist Blue Gum Forest	From Mt. Kembla on lower to mid escarpment slopes south to the Shoalhaven River.	243.34	40.0	12506	8
9	Moist Coastal White Box Forest	From Mt. Kembla on lower to mid escarpment slopes south to the Shoalhaven River.	191.81	28.2	>3000	6

	Community Name	Distribution in Sydney Basin Bioregion	Extant Area in Study Area Reserves (ha)	Proportion of Extant Area in Reserves (%)	Estimated Extant Bioregional Area (ha)	Proportion of Extant Area in NPWS Estate or SCA Catchment (%)
10	Moist Gully Gum Forest	South from Mt. Keira to Kiama LGA and extends across Narrabeen gullies of the southern Water Catchments.	709.32	66.0	>2736	90
11	Moist Blue Gum-Blackbutt Forest	Found on Narrabeen Gullies of the eastern Water Catchments. Shares some similarities with moist forests found along the Hacking River in Royal National Park.	64.56	33.0	>1200	74
12	Moist Brown Barrel Forest	South from Macquarie Pass National Park at higher elevations along the escarpment in Shellharbour, Kiama and Shoalhaven LGAs.	97.27	98.6	>3000	3
13	Moist Box-Red Gum Foothills Forest	South from Mt. Keira to Kiama LGA on lower escarpment slopes.	53.05	8.6	1022	2
14	Robertson Basalt Brown Barrel Forest	Remnants of this community are found across the Robertson Plateau and Southern Highlands on Basalt geologies.	2.38	63.5	935	54
15	Moist Shale Messmate Forest	Extensively distributed on higher elevations along the broader southern region escarpment and ranges. Also found west of the Study Area on the eastern Robertson Plateau.	36.40	41.3	7024	19
16	Escarpment Blackbutt Forest	South from Royal National Park along the escarpment to Mt. Keira, with isolated occurrences in Shellharbour and Kiama LGAs at lower elevations.	290.85	15.8	14811	62
17	Tall Open Gully Gum Forest	Poorly known outside the Woronora Plateau Catchments.	310.28	75.4	1160	100
18	Tall Open Peppermint-Blue Gum Forest	Poorly known outside the Woronora Plateau Catchments	77.05	64.7	1552	100

	Community Name	Distribution in Sydney Basin Bioregion	Extant Area in Study Area Reserves (ha)	Proportion of Extant Area in Reserves (%)	Estimated Extant Bioregional Area (ha)	Proportion of Extant Area in NPWS Estate or SCA Catchment (%)
19	Tall Open Blackbutt Forest	South from Royal National Park to Cataract Catchment. May prove similar to Blackbutt Forests of the South Coast Hinterlands.	21.58	15.1	2410	99
20	Tall Blackbutt-Apple Shale Forest	Localised community occurring between Royal National Park and Bulli Tops. Not described elsewhere.	23.09	14.2	379	97
21	O'Hares Creek Shale Forest	Restricted to Woronora, O'Hares and Cordeaux Catchments.	0	0	286	100
22	Highlands Shale Tall Open Forest	Found across the Southern Highlands, particularly near interface with Sandstone Plateaux near Bundanoon and Alpine.	25.38	91.9	8769	39
23	Coastal Grassy Red Gum Forest	South from Gwynneville to Shoalhaven LGA.	34.04	4.2	>1255	0.03
24	Lowland Woollybutt-*Melaleuca* Forest	South from Kembla Grange to Kiama LGA.	21.21	4.5	>490	0
25	Spotted Gum Open Forest	Mt. St. Thomas only. Relationships uncertain with Spotted Gum forests south of Kiama.	1.68	6.2	22706	11
26	Escarpment Edge Silvertop Ash Forest	Along the escarpment edge between Royal and Morton National Parks.	359.10	57.9	14953	64
27	Silvertop Ash Ironstone Woodland	Localised community found between Royal National Park and O'Hares Catchment.	20.59	25.1	1453	90
28	Sandstone Gully Apple-Peppermint Forest	North from Bulli Tops to the Georges River.	71.06	15.3	13285	51
29	Sandstone Gully Peppermint Forest	South from Bulli Tops to Morton National Park.	420.84	89.5	24500	79
30	Exposed Sandstone Scribbly Gum Woodland	Extensive across the Woronora Plateau south from Royal National Park.	614.76	39.6	37022	99
31	Nepean Enriched Sandstone Woodland	Restricted to Mittagong Formation Sandstone geologies in the Nepean Catchment. May also be found in the Buxton-Thirlmere area.	17.89	100	>5291	100
32	Exposed Bangalay-Banksia Woodland	From Royal National Park south to Austinmer.	27.64	18.6	737	82

	Community Name	Distribution in Sydney Basin Bioregion	Extant Area in Study Area Reserves (ha)	Proportion of Extant Area in Reserves (%)	Estimated Extant Bioregional Area (ha)	Proportion of Extant Area in NPWS Estate or SCA Catchment (%)
33	Coastal Sand Bangalay-Blackbutt Forest	Between Windang and Jervis Bay.	21.09	74.1	3181	39
34	Coastal Sand Swamp Mahogany Forest	South from Windang to Jervis Bay.	3.09	24.9	471	14
35	Alluvial Swamp Mahogany Forest	From Wyong south to Jervis Bay.	9.17	25.9	5222	9
36	Coastal Swamp Oak Forest	South from Newcastle to Jervis Bay.	49.39	20.5	4343	15
37	Riparian River Oak Forest	South from Marshall Mount Creek to at least the Shoalhaven River.	1.0	1.0	441	0.2
38	Highlands Swamp Gum-*Melaleuca* Woodland	South and west from Macquarie Hill. Poorly described elsewhere on the Southern Highlands.	8.55	79.6	>144	100
39	Coastal Sand Freshwater Wetland	South from Wyong to Jervis Bay.	2.46	73.9	8533	10
40	Upland Swamps: Tea-tree Thicket	Widespread across the Sandstone Plateaux of the Bioregion between Wollemi and Morton National Parks. Most extensive on the Morton and Woronora Plateaux. Generally described as part of various Sandstone Wet Heath Complexes.	7.68	26.0	>47000*	89*
41	Upland Swamps: Banksia Thicket	Widespread across the Sandstone Plateaux of the Bioregion between Wollemi and Morton National Parks. Most extensive on the Morton and Woronora Plateaux. Generally described as part of various Sandstone Wet Heath Complexes.	38.51	27.6	>47000*	89*
42	Upland Swamps: Sedgeland-Heath Complex	Widespread across the Sandstone Plateaux of the Bioregion between Wollemi and Morton National Parks. Most extensive on the Morton and Woronora Plateaux. Generally described as part of various Sandstone Wet Heath Complexes.	196.95	36.6	>47000*	89*

	Community Name	Distribution in Sydney Basin Bioregion	Extant Area in Study Area Reserves (ha)	Proportion of Extant Area in Reserves (%)	Estimated Extant Bioregional Area (ha)	Proportion of Extant Area in NPWS Estate or SCA Catchment (%)
43	Upland Swamps: Fringing Eucalypt Woodland	Widespread across the Sandstone Plateaux of the Bioregion between Wollemi and Morton National Parks. Most extensive on the Morton and Woronora Plateaux. Generally described as part of various Sandstone Wet Heath Complexes.	6.96	14.8	>47000*	89*
44	Upland Swamps: Mallee-Heath	Widespread across the Sandstone Plateaux of the Bioregion between Wollemi and Morton National Parks. Most extensive on the Morton and Woronora Plateaux. Generally described as part of various Sandstone Wet Heath Complexes.	25.49	43.4	>47000*	89*
45	Coastal Sand Scrub	From Wyong south to Ulladulla.	215.03	83.8	2041	3
46	Coastal Headland Banksia Scrub	Between Royal National Park and Austinmer.	19.23	35.0	>60	17
47	Budawang Ash Mallee Scrub	South from Wombarra to Kiama LGA.	4.40	41.6	>25	84
48	Rock Pavement Hath	Poorly described and mapped community. Likely to be widespread across Sandstone environments of the Bioregion.	1.76	100	>80	100
49	Rock Plate Heath-Mallee	Widespread though restricted to small areas of suitable habitat between Wollemi and Morton National Parks.	68.51	97.4	>1530	100
50	Beach Sands Spinifex	South from Newcastle to Ulladulla.	18.79	74.2	N/A	N/A
51	Coastal Headland Grasslands	South from Garie to Thirroul.	16.17	70.0	>30	N/A
52	Saltmarsh	South from Newcastle to Ulladulla.	2.80	5.8	1677	40
53	Estuarine Alluvial Wetland	South from Wyong to Kiama.	10.68	30.5	N/A	N/A
54	Floodplain Wetland	Between Newcastle and Ulladulla.	1.24	1.1	>4069	16

Study Area

Over 36 percent of the extant native vegetation within the Study Area is located within tenures that manage for the conservation of biodiversity values. These tenures include NPWS Estate and land managed by the Sydney Catchment Authority.

The reservation status of each vegetation community occurring within the Study Area varied between none of the extant distribution to all the remaining stands of the community. Distinct patterns also emerged between the different land use zonings underlying each of the vegetation communities. Appendix F provides a list of the Amalgamated Land Use Zoning Classes by Vegetation Community.

3.6.2 Disturbance Assessment

The aerial photographs show that about 45 percent of the remaining vegetation cover displays limited evidence of disturbance. It is not surprising that the least disturbed vegetation occurs on the steepest slopes and in the water catchment areas on the plateau. Evidence of heavy disturbance was observed in almost 20 percent of the vegetation cover. These are most common on the interface with developed landscapes. A further eighteen percent of vegetation was identified as supporting moderate patterns of disturbance. Map 9 shows the distribution of disturbance intensity observable from aerial photographs. Table 3.5 illustrates the broad area (ha) and proportional (%) figures within the Study Area. Table 3. 6 lists the area and proportion of each of the vegetation communities with observed high disturbance levels in the Study Area.

The most common disturbance feature is the presence of weeds. Almost seventeen percent of the remaining native vegetation cover supports weed infestations that are clearly observable from the air. An additional eight percent of the vegetation cover is dominated by weeds and exotic species. The combined figure of 25 percent of weed infestations across the vegetated landscape is likely to underestimate the total weed presence given that many weed infestations are not observable from API at the map scale.

TABLE 3.5: AREA AND PROPORTION OF DISTURBANCE ASSESSMENT INDEX WITHIN THE STUDY AREA

Disturbance Intensity Index	Area (ha)	Proportion of total Vegetation (%)
Low Disturbance (A Class)	8563.95	23.3
Moderate Disturbance (B Class)	3381.05	9.2
Heavy Disturbance (C Class)	2519.98	6.9
Scattered Trees	1211.34	3.3
Unassessed Native Vegetation	220.22	0.6
Weeds and Exotics	1645.61	4.5
Regenerating Vegetation	1321.20	3.6
Modified Lands	421.15	1.1
Cleared	17497.83	47.6
Total	36782.33	100

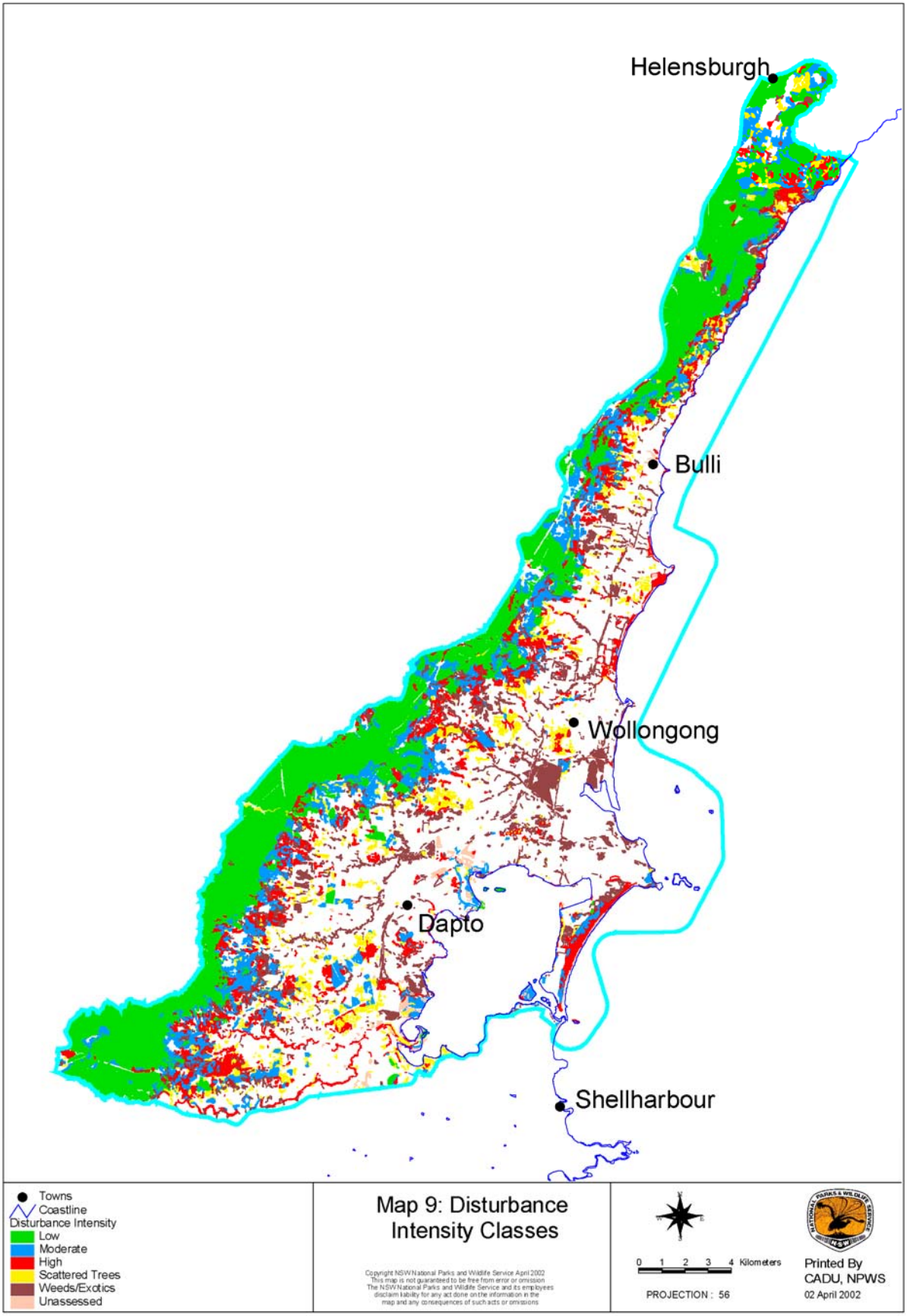
TABLE 3.6: AREA (HA) AND PROPORTION (%) OF HIGH DISTURBANCE INTENSITY CLASS BY VEGETATION COMMUNITY IN STUDY AREA

Community Name	High Disturbance Intensity Class* (ha)	Proportion of Community Highly Disturbed (%)
Spotted Gum Open Forest	26.9	100
Hind-Dune Littoral Rainforest	1.9	97.9
Riparian River Oak Forest	90.6	86.6
Coastal Sand Scrub	222.1	86.5
Coastal Headland Banksia Scrub	39.6	71.9
Coastal Sand Swamp Mahogany Forest	8.8	70.9
Coastal Grassy Red Gum Forest	521.1	65.4
Lowland Woollybutt-*Melaleuca* Forest	302.8	63.9
Moist Box-Red Gum Foothills Forest	357.3	57.6

Community Name	High Disturbance Intensity Class* (ha)	Proportion of Community Highly Disturbed (%)
Alluvial Swamp Mahogany Forest	17.7	50.0
Exposed Bangalay-Banksia Woodland	71.5	48.3
Coastal Swamp Oak Forest	110.0	45.5
Lowland Dry-Subtropical Rainforest	199.0	43.2
Escarpment Moist Blue Gum Forest	254.9	42.0
Escarpment Blackbutt Forest	662.4	36.0
Littoral Windshear Thicket	23.5	34.0
Coastal Sand Bangalay-Blackbutt Forest	8.4	29.4
Illawarra Escarpment Subtropical Rainforest	74.2	25.9
Coastal Headland Grasslands	5.8	25.0
Moist Coastal White Box Forest	133.4	19.7
Moist Shale Messmate Forest	16.3	18.4
Silvertop Ash Ironstone Woodland	13.4	16.3
Coachwood Warm Temperate Rainforest	327.6	14.3
Tall Blackbutt-Apple Shale Forest	18.3	11.2
Moist Blue Gum-Blackbutt Forest	23.4	8.3
Tall Open Gully Gum Forest	20.0	4.9
Exposed Sandstone Scribbly Gum Woodland	72.2	4.7
Moist Gully Gum Forest	44.4	4.1
Sandstone Gully Apple-Peppermint Forest	16.3	3.5
Tall Open Blackbutt Forest	4.3	3.0
Upland Swamps: Sedgeland-Heath Complex	11.9	2.2
Tall Open Peppermint-Blue Gum Forest	2.4	2.0
Escarpment Edge Silvertop Ash Forest	12.1	1.9
Banksia Thicket	1.8	1.3
Robertson Cool-Warm Temperate Rainforest	0	0
Cliffline Coachwood Scrub	0	0
Moist Brown Barrel Forest	0	0
Robertson Basalt Brown Barrel Forest	0	0
O'Hares Creek Shale Forest	0	0
Highlands Shale Tall Open Forest	0	0
Sandstone Gully Peppermint Forest	0	0
Nepean Enriched Sandstone Woodland	0	0
Highlands Swamp Gum-*Melaleuca*	0	0

Community Name	High Disturbance Intensity Class* (ha)	Proportion of Community Highly Disturbed (%)
Woodland		
Upland Swamps: Tea-tree Thicket	0	0
Upland Swamps: Fringing Eucalypt Woodland	0	0
Upland Swamps: Mallee-Heath	0	0
Budawang Ash Mallee Scrub	0	0
Rock Pavement Heath	0	0
Rock Plate Heath-Mallee	0	0

* Disturbance Class C (High) and Scattered Trees.


Helensburgh
Bulli
Wollongong
Dapto
Shellharbour
Towns
Coastline
Disturbance Intensity
Low
Moderate
High
Scattered Trees
Weeds/Exotics
Unassessed
Map 9: Disturbance Intensity Classes
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4 DISCUSSION

4.1 PATTERNS IN VEGETATION COMMUNITIES

4.1.1 Coastline Zone

The Coastline Zone (Fuller, 1980) describes a narrow band of environments that mark the interface between the land and the ocean. A number of aquatic vegetation communities are identifiable in this zone. Shallow submerged rock platforms that extend from major headlands along the coast support a dense green matting of seagrasses. Seagrass communities dominated by *Zostera capricorni* also flourish in estuarine and subtidal environments. Seagrasses occur on shallow mudflats and are most extensive on the eastern side of Lake Illawarra. Adjoining the high tide mark are small areas of Saltmarsh that now occupy less than 50 hectares in the Study Area. These saline environments are likely to have been depleted by land reclamation and lakeside developments. At several locations on the rim of Lake Illawarra, Saltmarshes can be seen to grade into dense stands of *Casuarina glauca*. These areas have been described and mapped as Coastal Swamp Oak Forest. The influence of salt water on this community can result in variation in the understorey, particularly as distance from the lake edge increases.

Sand Dune Systems are prominent in the Coastline Zone south of Wollongong. On the most exposed and mobile dunes a simple community of Beach Sands Spinifex develops. Classic seral progression in vegetation extends inland to where dunes are more stable, soil profiles deeper and protection from salt laden winds greater. Firstly, a heathy mosaic of *Banksia integrifolia* subsp. *integrifolia* and *Leptospermum laevigatum* occupy the foredunes behind Beach Sands Spinifex. This community has been mapped as Coastal Sand Scrub. Further back, hind dunes develop a low woodland comprising *Eucalyptus botryoides* and on higher dunes, *E. pilularis* (Coastal Sand Bangalay-Blackbutt Woodland). On swales and depressions between sand dunes the water table is higher providing preferable conditions for swampy vegetation. The Map Unit Coastal Sand Swamp Mahogany describes the assemblage of species including *Eucalyptus robusta*, *Gahnia clarkei, Baumea* spp. and *Schoenus brevifolius* that occupy these sites. In the most protected areas of the Sand Dune Complex, Hind-Dune Littoral Rainforest develops. Rainforest species such as *Planchonella australis* and *Endiandra sieberi* are characteristic of these patches, often below low emergents of *Eucalyptus botryoides*.

To the north of Wollongong, the landscape changes to one dominated by sea cliffs. At Thirroul the escarpment is closer to the sea and as a result sand dunes are replaced by headlands of clay, sandstone and coal measures. Some headlands have open native grasslands (Map Unit Coastal Headland Grasslands) present, the remnants of past clearing at major viewpoints such as Bald Hill. On exposed aspects directly above seacliffs, a tall scrub dominated *Banksia integrifolia* subsp. *integrifolia* and *Leptospermum laevigatum* occurs. Mapped as Coastal Headland Banksia Scrub, this community is more closely related to other communities occupying clay soils on headlands than it is to Coastal Sand Scrub, which shares similar structure. On protected headlands or in gullies approaching beaches a form of Littoral Rainforest develops. This is termed Littoral Windshear Thicket in this report. This thicket is variable in structure depending on exposure, but is always dominated by rainforest species. Most typical are *Acmena smithii, Guioa semiglauca* and *Ficus rubiginosa.* These three communities seem to correlate closely with communities described by Adam *et al.* (1989) which are extensive along the NSW coast. As distance from the seacliffs increases and aspects become more exposed to the prevailing south-easterly winds a woodland dominated by *Eucalyptus botryoides* and *Banksia integrifolia* subsp. *integrifolia* develops on steep, exposed slopes. This community, described as Exposed Bangalay-Banksia Woodland, is best developed on the Coalcliff and Stanwell Park escarpment slopes. These three communities are closely related through shared occurrence of species common to littoral environments. These include *Acmena smithii, Rapanea variabilis, Eucalyptus botryoides, Banksia integrifolia* subsp. *integrifolia* and *Lomandra longifolia.*

4.1.2 Coastal Plain

The Coastal Plain comprises the broad undulating landscapes between the lower escarpment foothills and the coastline zone. As Fuller (1980) notes, much of this area has been cleared for previous agricultural land use or for urban and industrial activities.

Native vegetation on soils derived from Quaternary Alluvium has been most extensively depleted. Data collected from these soils indicates that several different vegetation communities were once extensively distributed. On swampy riparian alluviums and floodplain depressions a forest comprising *Eucalyptus robusta*, *E. botryoides* and *Casuarina glauca* occurs as isolated remnants. Paperbarks such as *Melaleuca linariifolia* and *M. styphelioides* may have been abundant within this community along with an understorey of *Gahnia clarkei* and several sedge and rush species. This community has been described as Alluvial Swamp Mahogany Forest and is now limited in extent to a few isolated patches at Bellambi Lagoon, Puckeys Reserve and Wollingurry Creek. In some areas of alluvial depressions, standing water is present year round, retaining a complex of open swamps and reedlands. These have been mapped as Estuarine Alluvial Wetlands supporting species that include *Phragmites australis, Typha orientalis, Juncus* spp. and *Baumea* spp. Both of these alluvial communities form part of the Sydney Estuary Swamp Complex Endangered Ecological Community as determined under the Threatened Species Conservation Act, 1995. These communities appear to grade into dense stands of *Casuarina glauca* (Swamp Oak Forest) as the estuarine influences become more pronounced. These areas may have once been an obvious feature of the appropriately named Oak Flats.

Highly degraded freshwater wetlands remain on the floodplains of Kembla Grange, Duck Creek and Macquarie Rivulet Catchments. These areas have been mapped and described as Floodplain Wetlands and support an inconsistent floristic composition dependent on levels of water present and the degree of disturbance.

Elsewhere on the floodplain a grassy Eucalypt forest dominated by Red Gums (*Eucalyptus tereticornis*, *E. amplifolia)* occurs and forms a community described as Coastal Grassy Red Gum Forest. A number of variants appear to occur within it, the first describing a complex of Red Gum and Stringybark (*E. eugenioides)* types with a *Melaleuca styphelioides* canopy associate. *Eucalyptus bosistoana* is unique to this community and remnant trees of this species are a feature of the coastal plain. Near Towradgi and Gwynneville this community supports *Eucalyptus paniculata* subsp. *paniculata* and *E. pilularis* in the canopy as associate species to *E. tereticornis*. In their present state all are characterised by an abundant and diverse cover of grasses. On the fringe of the alluvial soil and the low gently sloping Permian geologies of the Shoalhaven group sediments, *Eucalyptus tereticornis* becomes temporarily less abundant and is replaced by a distinct forest of *E. longifolia* and *Melaleuca decora.* These environments may reflect a greater influence of clay in the soil, with *Eucalyptus pilularis* emerging as an occasional associate tree species. The remnants in Yallah-Albion Park form the core of the remaining distribution. This community, described as Lowland Woollybutt-*Melaleuca* Forest, is closely related to Coastal Grassy Red Gum Forest. Both form part of the Illawarra Lowlands Grassy Forest Endangered Ecological Community as determined under the Threatened Species Conservation Act, 1995.

Macquarie Rivulet and Marshall Mount Creek in the Calderwood Valley support a riparian vegetation community not found further north in the Study Area. Tall River Oak *(Casuarina cunninghamia* subsp. *cunninghamia*) form narrow ribbons along the banks of these streams on the coastal plain. *Casuarina glauca* and *Melaleuca* spp. replace this community as the influence of tidal water increases near the edge of Lake Illawarra.

The low hills of the coastal plain feature three different geological types. In north of the LGA, between Fairy Meadow and Bulli, soils derived from the Illawarra Coal Measures are prevalent. These tend to be long gently rising spurs extending from the escarpment foothills. Escarpment Blackbutt Forest remains on these slopes in isolated patches. Porphyritic latites of the Berkeley Hills supports regenerating examples of Lowland Dry-Subtropical Rainforest as well as Moist Box-Red Gum Foothills Forest. The latter now persists as isolated trees in an urban landscape. The vegetation of the Berkeley Hills has been previously referred to as "Berkeley Brush" (Mills & Jakeman 1995) acknowledging the once extensive rainforest that covered this environment. Volcanic Sandstone of the Shoalhaven Group is the third geological feature of the undulations of the coastal plain. It supports the most diverse number of vegetation communities. On the low hills in Wollongong, Mangerton and Coniston a number of vegetation communities are present. In the deep gullies at Mangerton Park, Escarpment Moist Blue Gum Forest is present characterised by tall *Eucalyptus saligna* and a tall rainforest subcanopy. On the slopes and crests *Eucalyptus pilularis* is the dominant tree species with a grassy and shrubby understorey. Samples of these forests grouped with those defining Escarpment Blackbutt Forest. At Mount St. Thomas and Mount Drummond a unique community of *Corymbia maculata* occurs on east facing hills. This has been described and mapped as Spotted Gum Open Forest. Many species found at the sample site are shared with Escarpment Blackbutt Forest. Caution is needed with this comparison, as much of the remnants of this community are heavily weed infested, probably masking the original composition of the forest.

Two Red Gum Forest types occur on the low hills of volcanic sandstone west of Lake Illawarra. Moist Box-Red Gum Foothills Forest and Coastal Grassy Red Gum Forest vary in relation to aspect and rockiness of the ground cover. These are discussed in more detail below.

4.1.3 Escarpment Foothills

The Escarpment Foothills mark the transition between the tall forests and rainforests of the escarpment slopes and the grassy forests of the lower slopes and plains. The mosaic of benches and spurs are more developed and complex to the south of Wollongong city. Much has been cleared from these areas with much of the remaining vegetation heavily disturbed and carrying dense weed infestations. On protected slopes and minor gullies a moist forest dominated by *Eucalyptus quadrangulata* and *E. tereticornis* is present. A distinctive understorey layer comprises many hardy rainforest species such as *Cassine australis* var. *australis* and *Backhousia myrtifolia.* In minor gullies of hillslopes this understorey can be dominated by dense stands of *Melaleuca styphelioides*. This vegetation community has been described as Moist Box-Red Gum Foothills Forest and forms remnant vegetation along narrow bands north to Keiraville.

On exposed aspects and narrow ridges of escarpment spurs, the vegetation is distinctively drier. While *Eucalyptus tereticornis* is still present, a number of stringybark species *(E. eugenioides* and *E. globoidea)* become increasingly abundant. The ground cover changes from a moist low shrub layer to a dense and diverse cover of native grasses dominated by *Themeda australis.*

In locations where shelter from winds is provided and soil moisture is retained by rocky scree of latites and volcanic sandstones, a low rainforest develops. The rainforest marks a gradation from the surrounding moist Eucalypt forest and as a result, many of the rainforest species are shared between the two. The rainforest often features a canopy dominated by low sprawling *Ficus rubiginosa* in combination with other species such as *Geijera salicifolia* var. *salicifolia, Cassine australis* var. *australis* and *Alectryon subcinereus*. In the most heavily dissected gully lines in the escarpment foothills, this rainforest becomes taller and tends to include a canopy dominated by *Dendrocnide excelsa* and *Toona ciliata* providing a distinctive subtropical influence. The gradation of these rainforests have been described and mapped as Lowland Dry-Subtropical Rainforest. These rainforests are distinctively different from those found on the escarpment slopes. They are also likely to have experienced the highest levels of depletion given that the preferred habitat coincides with gentle slopes, gullies and benches of the escarpment foothills, an area now extensively cleared.

In many of these areas, a natural regeneration of dense *Acacia* has occurred, following past clearing. These support a mixture or shrubs and weeds depending on location. *Acacia mearnsii* forms dense impenetrable thickets, sometimes in combination with other *Acacia* species and *Syncarpia glomulifera* subsp. *glomulifera.* The invasive weed *Lantana camara* is also often present. Probably occupying sites that were once moist sclerophyll and rainforest, these Acacia Scrubs are a common feature and may support important native species.

North of Mount Keira, the escarpment lower slopes are covered with Escarpment Blackbutt Forest with a warm temperate rainforest present in narrow gully lines. These are discussed in more detail below.

4.1.4 Escarpment slopes

The Wollongong escarpment supports a complex of Moist Forests and Rainforests. A gradient between the Northern and Southern Escarpment is also apparent in this landscape. North of Mt. Keira, the Map Unit Escarpment Blackbutt Forest dominates the escarpment slopes. This Community occurs on the east facing slopes and spurs. It is characterised by *Eucalyptus pilularis* generally in association with a number of other Eucalypts. The understorey comprises both a moist shrub layer and a grassy ground cover and slight changes in aspect and soil depth can vary the abundance of the two. *Allocasuarina torulosa* is a distinctive species within this community, as it is rarely found within any others of the Study Area. Grazing and frequent fire appears to reduce this community to a simple open understorey dominated by *Lomandra longifolia.* Examples are found near housing developments on the north facing slopes behind Stanwell Park and Otford, and within Royal National Park in the far north of the LGA. Rainforest species become increasingly abundant where greater shelter is provided by changes in aspect.

Between Mt. Kembla and Mt. Keira the escarpment eucalypt forest changes. A tall mixed eucalypt forest of *Eucalyptus smithii, E. muelleriana, E. quadrangulata* and *E. elata* occurs above a tall though simple combination of rainforest shrubs and small trees. Described and mapped as Moist Gully Gum Forest,

this community is most extensive above the escarpment on the Narrabeen Sandstones in the Water Catchments of Avon and Cordeaux. As the cliff lines are sharper and taller in the south the community only spills over the escarpment edge on east facing spurs and colluvial deposits such as talus slopes. Regenerating *Acacia binervata* can feature prominently in the shrub layer of this community particularly where disturbance has occurred in the past, often in combination with a grassy ground cover.

The benches of the mid to upper escarpment support a combination of vegetation communities which are not found elsewhere in the Study Area. At the rear of escarpment benches nestled underneath prominent south facing cliff lines a tall diverse rainforest occurs. This rainforest most often supports large *Toona ciliata, Dendrocnide excelsa, Schizomeria ovata* and *Ficus* spp. in combination with other rainforest species typical of the surrounding warm temperate rainforest. Illawarra Escarpment Subtropical Rainforest represents the climax vegetation community of the escarpment. Subtropical influences in the rainforest species can be found in adjoining escarpment slopes, and in particular in upper escarpment gully lines. However, rarely are they as well developed as those found on the benches, with most supporting individual trees or vines amongst a combination of species more typical of Coachwood Warm Temperate Rainforest. On the less protected areas of the benches a tall wet sclerophyll forest develops. Two forests of similar floristic composition have been described and mapped: Escarpment Moist Blue Gum Forest and Moist Coastal White Box Forest. Both support a tall rainforest subcanopy that includes *Cryptocarya* spp., *Acmena smithii* and *Doryphora sassafras.* A number of prominent species within Warm Temperate-Subtropical Rainforest also occur although at lower abundance. These include *Toona ciliata, Diploglottis australis* and *Dendrocnide excelsa.* These two forests have been separated on the relative abundance of the dominant canopy species of *Eucalyptus salignaXbotryoides* or *E. quadrangulata*. Moist Coastal White Box Forest is most extensive on the benches and gentle slopes and gullies south of Mount Kembla while Escarpment Moist Blue Gum Forest occupies similar habitat to the north.

Coachwood Warm Temperate Rainforest forms extensive bands along south facing upper slopes and gully lines of the escarpment. *Ceratopetalum apetalum* and *Doryphora sassafras* are the prominent canopy species. It occurs on steeper escarpment slopes and gully lines along the entire length of the escarpment between Royal and Macquarie Pass National Parks. A simpler though closely related variant occurs in the deep gullies along the Narrabeen gullies of the Avon, Cataract and Cordeaux water catchments. Variation within this community can result in response to elevation, rainfall, exposure and soil development. On upper sections of the escarpment, species richness levels appear to fall (Mills & Jakeman 1995) in response to increases in elevation.

4.1.5 Escarpment Cliffs

The escarpment cliffs and upper escarpment slopes provide habitat for a complex of scrubs, heaths and mallees. Directly below the cliffline a stunted scrub, dominated by *Ceratopetalum apetalum* grows in combination with species found more extensively across the sandstone plateau. Species may include *Banksia serrata, Epacris longiflora* and *Tristaniopsis collina.* The escarpment cliff complex has been mapped as one unit, Cliffline Coachwood Scrub, although there are several vegetation communities within it. The sheer cliff face and scale of the variations are too small to define at the mapping scale.

High rainfall contributes to the persistence of mesic species within the sandstone scrubs. At several disjunct locations along the edge of the escarpment, a unique mallee-woodland of *Eucalyptus dendromorpha*, *Syncarpia glomulifera* subsp. *glomulifera* and *E. sieberi* can be found. Stunted *Ceratopetalum apetalum* and *Schizomeria ovata* were found at the sample site amongst *Leptospermum polygalifolium* subsp. *polygalifolium* and *Melaleuca squarrosa*. Budawang Ash Mallee Scrub, as it has been described in this report, covers less than 10 hectares of the Study Area.

4.1.6 Plateau

The Woronora Plateau is an extensive area of native vegetation to the west of the Study Area. More detailed investigations of the plateau are currently underway (NPWS, 2002) and the descriptions for this study are restricted to a narrow band along the top of the escarpment. Within this eastern strip of the plateau, variation in vegetation arises from changes in geology (from Hawkesbury and Narrabeen Shales, Basalt Intrusions and Wianamatta Shales).

The Hawkesbury Sandstones support two broad vegetation complexes. The first is an exposed ridgetop woodland comprising a high diversity of sclerophyllous shrubs and trees. This has been described and mapped as Exposed Sandstone Scribbly Gum Woodland. Scribbly Gums tend to be the most

conspicuous feature though a number of species occur, including *Eucalyptus racemosa, E. sclerophylla* and *E. haemastoma*. *Corymbia gummifera* and *Eucalyptus sieberi* are common associate species. The canopy is rarely tall and is most often open. The shrub layer is dense and is characterised by a mixture of *Banksia, Hakea* and *Leptospermum* species. In the northern plateau, *Banksia ericifolia* subsp. *ericifolia* virtually dominates the understorey in some areas of this community. These have been described as Banksia Thickets although following fire the diversity of the understorey may return. Banksia Thickets are also prevalent on the margins of the upland swamp complexes at Maddens Plains. Along the escarpment edge and on the summits of Mt. Kembla and Mt. Keira, an exposed Forest dominated by *Eucalyptus sieberi* and *E. piperita* is found. Again the high rainfall of the escarpment edge provides suitable conditions that enable the persistence of species such as *Elaeocarpus reticulatus* and coral ferns (*Gleichenia* spp. and *Sticherus* spp.). This community, described as Escarpment Edge Silvertop Ash Open Forest, is closely related to the sheltered forests found elsewhere on the plateau.

Two sheltered vegetation communities on Hawkesbury Sandstones have been described and mapped, Sandstone Gully Apple-Peppermint Forest and Sandstone Gully Peppermint Forest. Both support similar forest structure, habitats and species although there is a distinct north to south gradient between the two. The most obvious difference is the absence of *Angophora costata* from the latter community. This species does not occur in the Study Area south of Bulli Tops. Other species are also less frequent, such as *Ceratopetalum gummiferum* and *Doryanthes excelsa*.

The Maddens Plains area supports vegetation associated with the Upland Swamps. These Upland Swamps occur on periodically waterlogged soils associated with the quaternary alluvial deposits on the plateau. A number of Map Units have been described spanning Sedgeland-Heath Complexes, Banksia Thicket, Mallee-Heath and Tea-tree Thicket. These have been related to more detailed studies of these habitats by Keith (1994) for the O'Hares Creek Catchment and Benson and Fallding (1985) for the southern areas of the plateau.

On Narrabeen soils on the deeper gully systems, tall open forest and rainforest develops. In the deepest gullies the rainforest conforms to a typical warm-temperate complex dominated by *Ceratopetalum apetalum* and *Doryphora sassafras*. At higher elevations at around 500 metres in the Avon Catchment rainforest species indicative of cooler climates appear in low abundance. These include *Quintinia sieberi* and *Fieldia australis.* Subtropical influences in the Coachwood Warm Temperate Rainforests are uncommon on the plateau within the Study Area. Such areas are restricted to small areas within gullylines on the Cordeaux Crinanite geology behind Mt. Kembla.

The Moist Eucalypt Forests of the Plateau share little in common with those below the escarpment. While the Moist Gully Gum Forest occurs both above and below the escarpment, relationships between the Blackbutt Forests and Blue Gum Forests are poor. On the plateau, *Eucalyptus pilularis* is commonly associated with tall *E. piperita* and less commonly *E. cypellocarpa*. These latter species are not found within Escarpment Blackbutt Forest. Similarly, the moist ground covers and shrubs are not as frequent or abundant on the plateau. Generally these tall Blackbutt forests support a simple ground cover of *Lomandra longifolia* and *Pteridium esculentum*. Tall wet sclerophyll forests occur on the edge of the warm temperate rainforest gullies. Moist Blue Gum-Blackbutt Forest describes a forest that shares a similar structure to Blue Gum Forests below the escarpment but does not have the subtropically influenced rainforest species. This is likely to arise from the relatively rapid fall in rainfall levels above the escarpment. Temperatures are also likely to be cooler as a result of the elevational difference.

At the southern end of the Study Area, remnant Wianamatta Shale soils form a ring around a basalt outcrop at Macquarie Hill. These soils support a tall grassy forest, described as Moist Shale Messmate Forest, comprising *Eucalyptus obliqua, E. cypellocarpa* and *E. piperita.* The understorey is open and dominated by *Poa* spp. and Tree Ferns such as *Cyathea australis*. The basalt outcrop on this hill supports the northern remnant of the once extensive Robertson Cool-Warm Temperate Rainforest. This community is listed as an Endangered Ecological Community under the Threatened Species Conservation Act, 1995. Another Endangered Ecological Community also occurs in minor patches on the escarpment edge. Tall *Eucalyptus fastigata* on a Basalt soil signify the presence of Robertson Basalt Brown Barrel Forest, a component of Robertson Basalt Tall Open-forest.

At the intersection of three geologies (Hawkesbury Sandstone, Basalt and Wianamatta Shale) on Macquarie Hill a moist heath/scrub occurs. Described as Highlands Swamp Gum-*Melaleuca* Woodland, it forms a low canopy of *Eucalyptus ovata* and *Melaleuca linariifolia* above sedges such as *Schoenus melanostachys*. This community is restricted to this hill in the Study Area although it is found elsewhere on the plateau.

4.2 REGIONAL STATUS OF VEGETATION COMMUNITIES

The Illawarra escarpment is a unique landscape. The proximity of the dramatic rise from a narrow coastal plain brings a combination of environmental characteristics that are rare in the Sydney Basin Bioregion and infrequent in NSW. High rainfall, moderate to high soil fertility and warm coastal temperatures provide a set of growth conditions that support many vegetation communities that are restricted to the Illawarra Region.

The regional analysis has shown that only a few vegetation communities within the Study Area share similar floristic composition to communities north of Sydney. Comparable communities are all restricted to a narrow band of communities that occur within the coastline zone. Poor floristic relationships were achieved for any of the vegetation communities in Wollongong with those present on the Cumberland Plain in Western Sydney.

The strongest relationships were revealed between the vegetation communities of immediately adjoining areas. The vegetation communities of the northern escarpment extend into Royal National Park along the Narrabeen Soils found on the slopes, sheltered gullies and headlands of the Hacking Catchment. The Woronora Plateau supports large areas of vegetation communities that grow on Hawkesbury Sandstone that are a continuation of those that have been described on the plateau environments of the Study Area. The Sedgeland-Heath Complexes and the Moist Eucalypt Forests also extend further west into the Water Catchments. Only the unique community of Budawang Ash Mallee Scrub is restricted to the escarpment edge between Wombarra and Kiama. Only three communities occur both above and below the escarpment: Moist Gully Gum Forest, Coachwood Warm Temperate Rainforest and Illawarra Escarpment Subtropical Rainforest.

Other vegetation communities appear to share close affinity to those found further south between the Shellharbour and Shoalhaven LGA's.

The vegetation of the Illawarra Region is perhaps best known for the Rainforests. Floyd (1990) recognises the Illawarra Region as one of the six rainforest centres of NSW. The Illawarra Region supports the most extensive area of rainforest in the Sydney Basin Bioregion. Within this region, Lowland Dry-Subtropical Rainforest and Illawarra Escarpment Subtropical Rainforest are unique to the LGA's of Wollongong, Shellharbour and Kiama.

The Illawarra Escarpment itself supports a distinctive gradient between northern and southern vegetation communities within the Wollongong LGA. The cross over point appears to lie between Mount Keira and Mount Kembla. The northern complex is typified by Escarpment Blackbutt Forests, Moist Blue Gum Forests, Coachwood Warm Temperate Rainforests, Exposed Bangalay-Banksia Woodlands and Littoral Windshear Thickets occurring on Narrabeen Clays and Sandstones. These communities extend north of the LGA to near Garie in Royal National Park. The southern area supports a completely different complex of Coastal White Box Moist Forest, Mixed Mountain Forests and Moist Brown Barrel Forest. These communities do not occur north of Wollongong and are restricted to the mid and upper escarpment slopes of the Shellharbour and Kiama LGA's.

Coastal plains and valleys extend along the length of the Sydney Basin Bioregion. However, the Illawarra Coastal Plain differs in that its geology is comprised of Permian volcanic sandstones, siltstones, shales and volcanic latites on a relatively narrow plain. Coastal Plains on the Central Coast and Lower Hunter Valley are characterised by Permian Sediments such as conglomerates and mudstones and the Cumberland Plain features soils derived from Wianamatta Shales. These landforms are both wider and drier than that found on the Illawarra Plain and consequently the combinations of vegetation communities differ. Moist Box-Red Gum Foothills Forests, Lowland Dry-Subtropical Rainforest, Lowland Woollybutt-*Melaleuca* Forests and Coastal Grassy Red Gum Forests are not found north of the Wollongong LGA and are limited in their southerly extent to Shellharbour and Kiama LGA's. The latter community forms an assemblage that is loosely affiliated in structure and habitat to other dry coastal forests present in the Bega and Towamba Valleys on the Far South Coast.

This study has identified that a number of vegetation communities that occur within the Study Area are poorly conserved within the Sydney Basin Bioregion. The following communities have less than five percent of their extant distribution occurring in NPWS or SCA managed lands:

- Coastal Grassy Red Gum Forest
- Lowland Woollybutt-*Melaleuca* Forest
- Moist Box-Red Gum Foothills Forest

- Lowland Dry-Subtropical Rainforest
- Riparian River Oak Forest
- Coastal Sand Scrub

It is highly likely that the conservation status of these communities is made more vulnerable by the depletion of large areas of the pre-European distribution. As a result, the use of reservation status as a proportion of remaining vegetation, this report is likely to overstate the proportion reserved against original distribution.

4.3 ENDANGERED ECOLOGICAL COMMUNITIES

The Scientific Committee has listed a number of vegetation assemblages as Endangered Ecological Communities under the Threatened Species Conservation Act, 1995. These communities are:

- Illawarra Lowlands Grassy Woodlands
- Sydney Coastal Estuary Swamp Complex
- Sydney Coastal Freshwater Wetland Complex
- Robertson Cool-Warm Temperate Rainforest
- Robertson Basalt Tall Open-forest
- Southern Highlands Shale Woodlands
- Illawarra Subtropical Rainforest
- O'Hares Creek Shale Forest

These communities are broadly described in the determination using typical habitat and characteristic plant species present. In a number of determinations particular locations are given as examples of the Endangered Community. Site based classification corresponded well with some of the intuitively based classification systems used to underpin the determinations.

TABLE 4.2: RELATIONSHIP BETWEEN ENDANGERED ECOLOGICAL COMMUNITIES (TSC ACT, 1995) AND VEGETATION COMMUNITIES DESCRIBED IN THIS REPORT

Endangered Ecological Community Name	Corresponding Vegetation Community (this report)
Illawarra Coastal Grassy Woodlands	Coastal Grassy Red Gum Forest Lowland Woollybutt-*Melaleuca* Forest
Sydney Coastal Estuary Swamp Forest Complex	Alluvial Swamp Mahogany Forest Estuarine Alluvial Wetland Coastal Swamp Oak Forest (May contain components) Floodplain Wetlands (In areas with brackish influence)
Sydney Coastal Freshwater Wetland Complex	Coastal Sand Freshwater Wetland
Robertson Rainforest	Robertson Cool-Warm Temperate Rainforest
Robertson Basalt Tall Open-forest	Moist Shale Messmate Forest Robertson Basalt Brown Barrel Forest
Southern Highlands Shale Woodlands	Highlands Shale Tall Open Forest
Illawarra Subtropical Rainforest	Lowland Dry-Subtropical Rainforest
O'Hares Creek Shale Forest	O'Hares Creek Shale Forest

Table 4.2 indicates the relationship between the determinations and the classification used in this report. Illawarra Coastal Grassy Woodlands describes a broad community found on the coastal plain and foothills which corresponds with two assemblages defined in this report; Coastal Grassy Red Gum Forest and Lowland Woollybutt-*Melaleuca* Forest. The wetland communities that have been listed under the Act

have not been extensively sampled in this project as the focus has been on the escarpment. Sydney Coastal Freshwater Wetland Complex is limited in extent within the Wollongong LGA.

Sydney Coastal Estuary Swamp Forest Complex is a broad classification that encompasses a number of different vegetation structures and assemblages. Alluvial Swamp Mahogany Forest and Estuarine Alluvial Wetland clearly forms part of the determination. The determination makes clear that pure stands of Swamp Oak are not included in the determination although site data derived from this project found close relationships between the swamps and Coastal Swamp Oak Forests. Users will need to identify on a site by site basis which components of areas mapped as Coastal Swamp Oak Forest may contain assemblages described in the determination. Areas of Floodplain Wetlands that have brackish influences may also be included within the definition of Sydney Coastal Estuary Swamp Complex.

Robertson Cool-Warm Temperate Rainforest and Robertson Basalt Tall Open Forest both occur at Macquarie Hill and represent the northern limit of this Endangered Communities. Southern Highlands Shale Woodlands is a broadly defined community that is mainly found within Wingecarribee LGA to the west of the Study Area. Moist Shale Messmate Forest, found on soils derived from Wianamatta Shales, may represent this community in its eastern, high rainfall form.

Illawarra Subtropical Rainforest has recently been listed as an Endangered Ecological Community. This community encompasses that described by Lowland Dry-Subtropical Rainforest in this report. It excludes the warm temperate influenced subtropical rainforests found on the escarpment benches.

O'Hares Creek Shale Forest is prevalent in the Darkes Forest area with a small proportion found within the study area.

4.4 DISTURBANCE ASSESSMENT: CONDITION VS CONTRIBUTION

The assessment of condition has been completed in order to develop a relative index of disturbance for each patch of native vegetation. The process used is limited by the disturbance patterns observable from aerial photographs and the subjective criteria used to weight condition.

Importantly, it can provide an indication of the health of the entire distribution of a map unit within the Study Area. Some map units are consistently degraded across their range, with no remnants of that type displaying an absence of disturbance patterns. This is not a reason for the rejection of such patches of vegetation on the basis that they have no contribution to a conservation goal of biodiversity conservation. Rather, it suggests that the issues confronting the management of the vegetation community are more difficult and complex. The contribution of a patch of vegetation will depend on its environmental protection status across the region. How to improve and configure its protection can then rely on the relative condition of remnants to prioritise conservation works.

Table 4.3 lists those vegetation communities that have been assessed as having heavy disturbance indicators across over 50 percent of their extant distribution. These may indicate that threatening processes continue to operate on these communities irrespective of their reservation status. In most cases this threat arises from disturbance that allows the continued spread and proliferation of invasive weed species. Map 10 shows the distribution of the severely (>75%) and highly (50-75%) disturbed communities within the Study Area. Wetland communities have not been included within Table 4.3, due to the difficulties determining the levels of disturbance that have occurred. However, it is likely that they have been significantly modified from their original condition.

TABLE 4.3: HEAVILY DISTURBED (>%50 CLASS C) VEGETATION COMMUNITIES

	Community Name	Proportion of Vegetation Community with High Disturbance (%)
1	Spotted Gum Open Forest	100
2	Hind-Dune Littoral Rainforest	97.9
3	Riparian River Oak Forest	86.6
4	Coastal Sand Scrub	86.5
5	Coastal Headland Banksia Scrub	71.9
6	Coastal Sand Swamp Mahogany Forest	70.9
7	Coastal Grassy Red Gum Forest	65.4

	Community Name	Proportion of Vegetation Community with High Disturbance (%)
8	Lowland Woollybutt-*Melaleuca* Forest	63.8
9	Moist Box-Red Gum Foothills Forest	57.6
10	Alluvial Swamp Mahogany Forest	50.0

4.5 CONSERVATION VALUE ASSESSMENT

Assessment of the conservation value of the vegetation was undertaken by examining the proportion of the estimated area of each community found in the Sydney Basin Bioregion against NPWS Estate. At a local level, proportions of each community were calculated against the broad land use zonings found in the Wollongong LGA

A more thorough analysis would undertake a review of a wide range of factors and use clear quantitative criteria. One such criteria, defined by JANIS (1997), seeks to examine the adequacy and representativeness of protection by reviewing the proportion of each community against pre-European distributions. It augments this analysis by determining how protection measures are configured across the range of the community so that internal variation within each community is sufficiently protected. Other criteria examine the degree of fragmentation and isolation of each community by calculating the proportion of the community located in various patch sizes, and the contiguity of remaining patches to other vegetation. This second calculation will be undertaken as part of the Conservation Priorities report.

While these calculations remain an attractive future endeavour, our simple analysis revealed strikingly consistent patterns in the relative values of the different vegetation communities. The native vegetation communities of the coastal plain and foothills are united by high levels of disturbance across their distribution and are poorly conserved at both a local and regional level. Given the occurrence of these communities in areas that have been preferentially selected for agricultural and urban land uses, it can also be concluded that much of their original distribution has been heavily depleted.

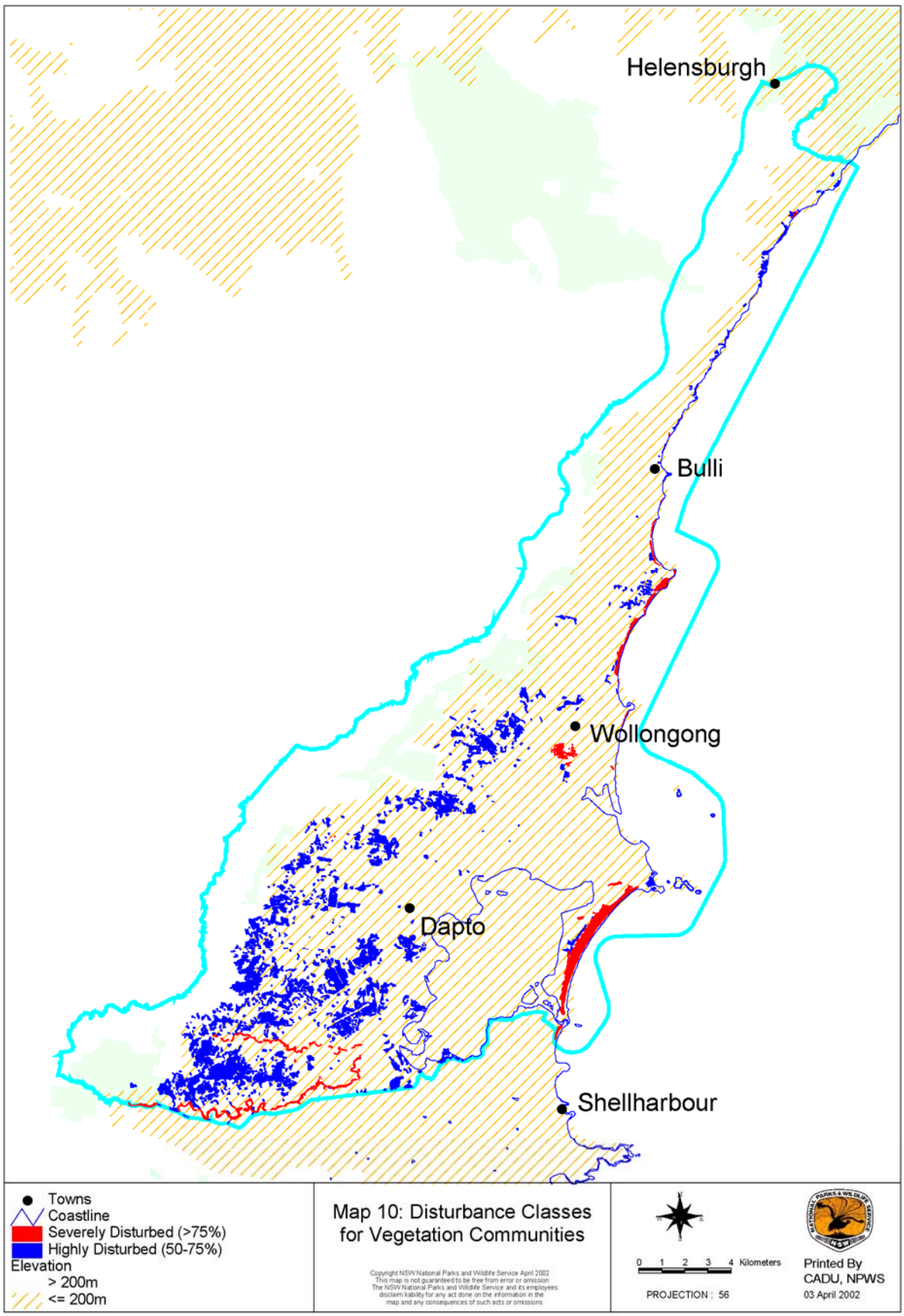
The combination of these factors have led to the listing of the Illawarra Lowlands Grassy Woodlands as an endangered ecological community under the Threatened Species Conservation Act, 1995. This community consists of two communities mapped for this report, Coastal Grassy Red Gum Forest and Lowlands Woollybutt-*Melaleuca* Forest.

A number of other communities share similar characteristics to those already listed under the TSC Act (1995). These include Riparian River Oak Forest, Moist Box-Red Gum Foothills Forest and Lowland Dry-Subtropical Rainforest. Coastal Sand Scrub is poorly reserved regionally and heavily disturbed in the Study Area, although much of its remaining distribution is already protected in Crown Land at Windang. Hind-Dune Littoral Rainforest has virtually been cleared from the Study Area, with only a few isolated patches remaining on the Windang Peninsula and Korrongulla Wetland. Table 4.4 lists those communities that have less than 30 percent of their extant distribution in the Study Area within formal and informal reserves. Map 11 shows the distribution of the vegetation communities that have less than 5, 15 and 30 percent of their extant distribution within these combined land tenures.

Estuarine and Alluvial Swamp Forests and Wetlands are also like to have experienced high levels of clearing. The data indicates that much of what remains in the Study Area today is highly disturbed and modified. Only moderate levels of reservation protection are afforded for these communities.

The native vegetation of the escarpment is better protected by virtue of the topography. North of Wollongong, escarpment forests merge with those found on the deep shale gullies, sheltered slopes and headlands in Royal National Park. The tall moist forests that are prominent on lower slopes, benches and gullies such as Escarpment Moist Blue Gum Forest and Moist Coastal White Box Forest have moderate reservation levels at both a local and regional level. Coachwood Warm Temperate Rainforest is an extensive and well conserved community throughout the region. Good examples of Illawarra Escarpment Subtropical Rainforest are retained in both formal and informal reserves of the Study Area. The regional status of this community requires further analysis, although it is likely that the community extends along the length of the Illawarra escarpment and occurs in formal reserves (NPWS, 2000a).

The Study Area also contains the eastern edge of the extensive Woronora Plateau. While many of the vegetation communities present along this section are found in greater area to the west of the Study Area, a number of communities are strongly related to the escarpment edge itself. These include Cliffline Coachwood Scrub and Budawang Ash Mallee Scrub.


Helensburgh
Bulli
Wollongong
Dapto
Shellharbour
Towns
Coastline
Severely Disturbed (>75%)
Highly Disturbed (50-75%)
Elevation
> 200m
<= 200m
Map 10: Disturbance Classes for Vegetation Communities
Copyright NSW National Parks and Wildlife Service April 2002
This map is not guaranteed to be free from error or omission
The NSW National Parks and Wildlife Service and its employees
disclaim liability for any act done on the information in the
map and any consequences of such acts or omissions
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PROJECTION : 56
Printed By
CADU, NPWS
03 April 2002

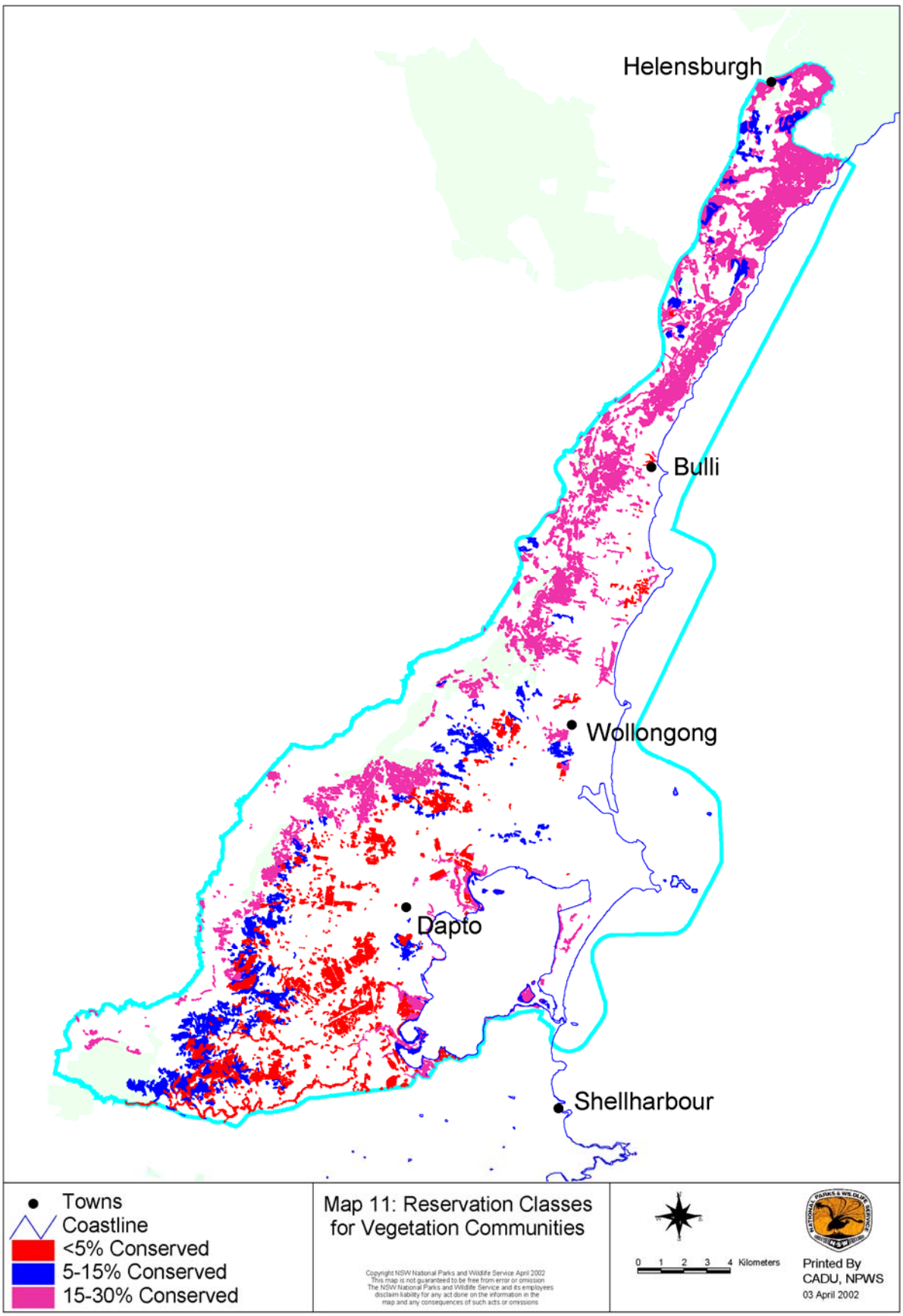
Helensburgh
Bulli
Wollongong
Dapto
Shellharbour
Towns
Coastline
<5% Conserved
5-15% Conserved
15-30% Conserved
Map 11: Reservation Classes for Vegetation Communities
Copyright NSW National Parks and Wildlife Service April 2002
This map is not guaranteed to be free from error or omission
The NSW National Parks and Wildlife Service and its employees disclaim liability for any act done on the information in the map and any consequences of such acts or omissions
0 1 2 3 4 Kilometers
Printed By
CADU, NPWS
03 April 2002

TABLE 4.4: POORLY CONSERVED (<30% OF EXTANT RESERVED) VEGETATION COMMUNITIES WITHIN WOLLONGONG STUDY AREA

	Community Name	Proportion of Extant Vegetation Community Reserved within the Study Area(%)
1	O'Hares Creek Shale Forest	0
2	Riparian River Oak Forest	1.0
3	Floodplain Wetlands	1.1
4	Coastal Grassy Red Gum Forest	4.2
5	Lowland Woollybutt-*Melaleuca* Forest	4.5
6	Saltmarsh	5.8
7	Spotted Gum Open Forest	6.2
8	Moist Box-Red Gum Foothills Forest	8.6
9	Tall Blackbutt-Apple Shale Forest	14.2
10	Lowland Dry-Subtropical Rainforest	14.3
11	Upland Swamps: Fringing Eucalypt Woodland	14.8
12	Tall Open Blackbutt Forest	15.1
13	Robertson Cool-Warm Temperate Rainforest	15.2
14	Sandstone Gully Apple-Peppermint Forest	15.3
15	Escarpment Blackbutt Forest	15.8
16	Cliffline Coachwood Scrub	16.5
17	Exposed Bangalay-Banksia Woodland	18.6
18	Coastal Swamp Oak Forest	20.5
19	Coastal Sand Swamp Mahogany Forest	24.9
20	Silvertop Ash Ironstone Woodland	25.1
21	Alluvial Swamp Mahogany Forest	25.9
22	Upland Swamps: Tea-tree Thicket	26.0
23	Upland Swamps: Banksia Thicket	27.6
24	Moist Coastal White Box Forest	28.2

4.6 FIELD IDENTIFICATION OF VEGETATION COMMUNITIES

Each Vegetation Community Profile includes a description of key identifying features and a list of diagnostic species. The diagnostic species list is presented to guide users in the process of differentiating communities from one another or confirming the type of vegetation at a site of interest. The list of diagnostic species has been drawn from site data collected for use in this project. They do not represent the total list present at any given location or within any given community. The first thing to note is the number of replicates that have been used to describe the community. Vegetation communities that are described using fewer site numbers are likely to have considerably more variation and less accuracy in the diagnostic species list than those with a high numbers of replicates.

The Fidelity Class column lists up to three types of species: positive, negative and constant. A fourth type called 'uninformative' is not presented in this list but may be present in the Floristic Summary list in the profile if it is a conspicuous species or a canopy species. Table 4.5 provides an example from which to discuss the interpretation of the diagnostic species list.

Group Score and Frequency: These refer to the frequency and median cover abundance at which these species have occurred in the sites that have been used to define this community. Using the table below it can be seen that *Croton verreauxii* occurred in 82 percent of sites that describe MU X. Of these sites, the median abundance score was 3 (5-20 percent).

Non Group Score and Frequency: These provide a comparative cover abundance and frequency of occurrence for this species across all other sites (communities). In this example, *Croton verreauxii* has occurred in 23 percent of all other sites at a cover abundance of 3.

Positive species are those that are recorded more frequently and at higher abundances within a given Vegetation Community compared to all other communities in the Study Area. They may also be species that are unique to that community, that is, they were not found amongst sites that defined any other community. In this example (Table 4.5) it is seen that *Cassine australis* var. *australis* occurs at 100 percent of the sites within this community at a mean cover abundance of 4, while it occurred in only 35 percent of all other sites at a lower mean cover abundance. It is also noted that *Ficus superba* var. *henneana* is unique to this community, and has not been recorded in any other sites (Non-Group Frequency equals 0).

TABLE 4.5 EXAMPLE DIAGNOSTIC SPECIES LIST – MAP UNIT X

Species Name	Group Score	Group Freq	Non Group Score	Non Group Freq	Fidelity Class
Cassine australis var. australis	4	1.00	3	0.35	positive
Cayratia clematidea	2	0.55	1	0.24	positive
Croton verreauxii	3	0.82	3	0.23	positive
Diospyros australis	4	0.91	1	0.40	positive
Diospyros pentamera	1	0.09	0	0.00	positive
Doodia aspera	3	0.55	3	0.46	positive
Ficus superba var. henneana	5	0.09	0	0.00	positive
Pittosporum multiflorum	3	0.91	2	0.34	positive
Planchonella australis	4	0.73	4	0.10	positive
Streblus brunonianus	5	1.00	1	0.22	positive
Eustrephus latifolius	1	0.91	2	0.65	negative
Livistona australis	0	0.00	2	0.52	negative
Pittosporum undulatum	1	0.82	3	0.62	negative
Geitonoplesium cymosum	2	0.91	2	0.61	Constant
Pandorea pandorana subsp. pandorana	2	1.00	2	0.61	Constant

Negative species are the inverse in that they are recorded less frequently and at lower abundance in the given community relative to all others. It may also be that the species has never been recorded within the sites that describe the given community. In this example it is noted that *Livistona australis* has not been recorded at all in this community (Group Frequency score of 0), and that it occurs in 52 percent of sites outside this community. *Eustrephus latifolius* has also been recorded as a negative diagnostic species even though it has occurred in 91 percent of the sites within the community, though at a lower cover abundance than at other sites. The Non Group scores indicate that generally this species occurs with a higher abundance elsewhere than recorded within this group so it is not an indicator species for this community.

Constant species are those that occur at relatively consistent frequencies and abundance across all communities and are not useful in differentiating vegetation communities but are useful in describing them. In this example it can be seen that *Pandorea pandorana* subsp. *pandorana* has occurred in 100 percent of sites within the community, at a mean cover abundance of 2. This does not help to

differentiate this community as the species was recorded in 61 percent of all other sites also with a mean cover abundance of 2.

Diagnostic species are a guide only. They can be misleading in that species that appear as unique to or absent from a community may result from insuffi cient sampling. However, wi th communities that have been sampled by a larger number of replicates, diagnostic species can be used to id entify particular communities from one another, particularly if identica l field survey methods are employed. Reliability of identification will increase with th e greater number of positive diagnostic species identified at a site. Confidence can also be i mproved with an und erstanding of the habitat and structural characteristics of the vegetation community of interest.

4.7 MAP ACCURACY

The derived map of vegetation com munities has a number of po tential sources of error. The sp atial or positional accuracy has already been described. Nevertheless, it is impo rtant to reiterate that the distortion arising from the steep Illawarra escarpment is si gnificant and has generated spatial discrepancies of up to 70 metres between aerial photo layer and 1:25 000 topographic maps.

Errors may also arise from misinterpretations of canopy patterns or interpretation difficulty. The latter can be assessed using the reliability code present in the digital coverage. Coding error may also arise during the data transfer process.

The derived vegetation community map relied on spatial data layers that are compiled at smaller scales. The Geology and Soil Landscape layers are available at 1:50 000 and 1:100 000 scale respectively and may themselves contain errors.

Finally, vegetation community boundaries rarely change abruptly. The transition between one community and another tends to be gradual and as such a line used to separate the two can be misleading.

4.8 USING THE MAP AND REPORT

This report and accompanying report provides environmental planners with the opportunity to address the conservation value of local vegetation. It provides information that identifies:

- the regional distribution of each vegetation community in the Study Area;
- the intensity of disturbance present in areas of native vegetation on a site by site basis;
- the degree of disturbance across the distribution of each vegeta tion community across the Study Area;
- the percentage of extant area of each community that is reserved at a local and regional level; and
- the distribution of ea ch vegetation community across the m ajor land use zonings allocated by the Wollongong Local Environmental Plan.

The vegetation map is available as an electronic data layer for use with GIS systems. These data layer supports a number of additional features that can be used for site by site assessments. A large n umber of feature codes are allocated to the mapped polygons. These features can be used to:

- Map the extent of weed and exotic vegetation present in the Study Area;
- Identify and map the features of modified landscapes including land fill;
- Understand variations in the understorey characteristics of the vegetation communities;
- Obtain more detailed information on the type of canopy species present at a site; or
- Obtain more detailed information on the type of disturbance present at a site.

This information should not be substituted for detailed site inspections.

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APPENDIX A: Vegetation Community Profiles

MU1 Illawarra Escarpment Subtropical Rainforest

❑ *DESCRIPTION*

Illawarra Escarpment Subtropical Rainforest is the most luxuriant form of rainforest found in the LGA. The forest is tall, often with billowing emergent rainforest trees rising over 35 metres in height, above a dense subcanopy. It supports a high diversity of canopy species including *Dendrocnide excelsa, Doryphora sassafras, Diploglottis australis, Toona ciliata, Ficus obliqua* var. *obliqua* and *F. rubiginosa*. In locations free of recent disturbance, majestic examples of these species are present. The subcanopy supports species such as *Pennantia cunninghamii, Cryptocarya* spp., *Livistona australis, Polyosma cunninghamii, Acmena smithii* and *Doryphora sassafras*. An abundance of woody vines and lianes such as *Piper novae-hollandiae* and *Palmeria scandens* contribute to the exclusion of light from the forest floor providing suitable conditions for a cover of shade tolerant ferns. Many species found within this community are shared with Coachwood Warm Temperate Rainforest.

Illawarra Escarpment Subtropical Rainforest is most prominent on the rear of escarpment benches where deep clay soils, high rainfall and sheltered aspects occur in combination. Small isolated patches of this rainforest community are found in deep gullies underlain by richer soils derived from the Cordeaux Crinanite rocks near upper Cordeaux Dam and on the deep alluviums at Picnic Point adjoining the Hacking River in Royal National Park. Clearing of escarpment benches for mining, agricultural and residential land uses is likely to have reduced the original extent of the community in the Wollongong LGA.

Affinities with other rainforest communities in the Sydney Basin Region are uncertain. Analyses of site data indicated that isolated patches of rainforest communities in the Watagan Ranges on the Central Coast share a similar forest structure but a different floristic composition. To the south of the LGA, no similar community has been described in Shellharbour LGA (Mills, 2000). Mills & Jakeman (1995) note that similar rainforest stands occur in the Kangaroo Valley although species composition differs as a result of cooler temperatures. The degree of difference has not been tested by this project. Species composition of an aligned Forest Ecosystem defined by NPWS (2000a) "Coastal Hinterland Subtropical Warm Temperate Rainforest" shares many positive diagnostic species with Illawarra Escarpment Subtropical Rainforest. Floyd (1990) equates field locations that describe both classifications, describing Suballiance 14 *Doryphora-Daphnandra micrantha-Dendrocnide-Ficus-Toona*. Resolution of the relationship between the extent of the community to the south of the Study Area requires further clarification. Data on the regional distribution is presented on this understanding.

❑ *FLORISTIC SUMMARY*

Number of Sites: 16

Trees: 20-35m tall. Mean Projected Canopy Cover 66%

Doryphora sassafras, Livistona australis, Diploglottis australis, Acmena smithii, Cryptocarya glaucescens, Dendrocnide excelsa, Pennantia cunninghamii, Toona ciliata, Ceratopetalum apetalum, Ficus obliqua var. *obliqua, Ficus rubiginosa, Cryptocarya microneura, Diospyros australis*

Subcanopy Trees: 10-25m tall. Mean Projected Canopy Cover 40%

Polyosma cunninghamii, Clerodendrum tomentosum, Pittosporum undulatum, Claoxylon australe

Tall Shrubs: 1-10m tall. Mean Projected Canopy Cover 30%

Wilkiea huegeliana, Eupomatia laurina

Ground Covers: 0-1m tall. Mean Projected Canopy Cover 15%

Gymnostachys anceps, Arthropteris tenella, Microsorum scandens, Adiantum formosum, Pteris umbrosa, Elatostema reticulatum var. *reticulatum, Peperomia blanda* var. *floribunda, Pseuderanthemum variabile, Pittosporum multiflorum, Doodia aspera, Calochlaena dubia, Lastreopsis decomposita*

Vines & Climbers:

Palmeria scandens, Piper novae-hollandiae, Marsdenia rostrata, Pandorea pandorana subsp. *pandorana, Morinda jasminoides, Smilax australis, Eustrephus latifolius, Cissus hypoglauca, Marsdenia flavescens, Melodinus australis, Cissus antarctica*

Epiphytes:

Asplenium australasicum

❑ *KEY IDENTIFYING FEATURES*

Easily recognisable features to assist in identifying this map unit are:

- A dense, closed forest canopy comprising sometimes large and buttressed rainforest species including Sassafras (*Doryphora sassafras*), Cabbage tree palm (*Livistona australis*), Lilly pilly (*Acmena smithii*), Giant stinging tree (*Dendrocnide excelsa*), Brown beech (*Pennantia cunninghamii*), Red cedar (*Toona ciliata*), large Fig trees (*Ficus obliqua* var. *obliqua*, *Ficus rubiginosa*) and *Cryptocarya* spp. (*C. glaucescens* and *C. microneura*).
- Predominance of rhizomatous fern species climbing on rocks, logs, lianes and tree trunks including Fragrant fern (*Microsorum scandens*) and *Arthropteris tenella.*
- An abundance of large woody vines or lianes and the presence of Pepper vine (*Piper novae-hollandiae*) and Anchor vine (*Palmeria scandens*).
- Presence of epiphytes such as Birds nest fern (*Asplenium australasicum*) in the canopy and on rocks.
- The presence of shade dependant herbs and ferns such as *Elatostema reticulatum* var. *reticulatum*, *Peperomia blanda* var. *floribunda* and Jungle brake (*Pteris umbrosa*).

❑ *EXAMPLE LOCATIONS*

Mount Keira Scout Camp; Brokers Nose, Corrimal; Scarborough rainforest; Gibson track, Austinmer; Calderwood; Wongawilli.

❑ *CONSERVATION STATUS*

RESERVATION STATUS

Tenure	Study Area (ha)	Proportion of Total (%)	Sydney Basin Bioregion (ha/%)
National Park Estate	150.96	52.8	2415 (30)
Water Catchment	0	0	7 (0.1)
State Forest	0	0	
Wollongong City Council Reserves	6.95	2.4	
Reserved Subtotal	157.91	55.2	
Other	128.26	44.8	
Total	286.17	100	8114

CONDITION ASSESSMENT

Disturbance Class	Area (ha)	Proportion Extant (%)
A Light	88.87	31.1
B Moderate	123.11	43.0
C Heavy	74.19	25.9
Scattered trees	0	0
Total	286.17	100

❑ *THREATENED PLANT SPECIES*

Arthropteris palisotii (E1), *Daphnandra* sp. “Illawarra” (E1)

❑ *DIAGNOSTIC SPECIES*

Species Name	Group Score	Group Freq	Non Group Score	Non Group Freq	Fidelity Class
Acmena smithii	4	0.76	2	0.44	positive
Adiantum diaphanum	1	0.06	0	0.00	positive
Adiantum formosum	4	0.71	3	0.27	positive
Arthropteris tenella	2	0.88	2	0.17	positive
Asplenium australasicum forma australasicum	2	0.53	1	0.16	positive
Ceratopetalum apetalum	4	0.53	5	0.13	positive
Cryptocarya glaucescens	4	0.65	4	0.24	positive
Cryptocarya microneura	2	0.53	3	0.28	positive
Dendrobium pugioniforme	1	0.06	0	0.00	positive
Dendrocnide excelsa	4	0.65	1	0.06	positive
Diospyros australis	2	0.82	1	0.39	positive
Doodia aspera	2	0.59	3	0.45	positive
Doryphora sassafras	5	1.00	4	0.23	positive
Eupomatia laurina	2	0.94	2	0.27	positive
Ficus coronata	4	0.59	1	0.15	positive
Gymnostachys anceps	3	1.00	2	0.42	positive
Lastreopsis decomposita	4	0.53	3	0.18	positive
Livistona australis	4	1.00	2	0.44	positive
Microsorum scandens	4	0.94	2	0.09	positive
Morinda jasminoides	2	0.76	2	0.31	positive
Neolitsea dealbata	1	0.06	0	0.00	positive
Palmeria scandens	3	0.76	2	0.14	positive
Pennantia cunninghamii	4	0.71	1	0.05	positive

Species Name	Group Score	Group Freq	Non Group Score	Non Group Freq	Fidelity Class
Peperomia blanda var. floribunda	2	0.06	0	0.00	positive
Piper novae-hollandiae	4	0.71	1	0.07	positive
Pisonia umbellifera	1	0.06	0	0.00	positive
Pittosporum multiflorum	2	0.71	2	0.34	positive
Polyosma cunninghamii	2	0.59	2	0.09	positive
Pteris umbrosa	3	0.65	1	0.05	positive
Toona ciliata	5	0.59	1	0.14	positive
Eustrephus latifolius	1	0.76	2	0.66	negative
Geitonoplesium cymosum	1	0.18	2	0.68	negative
Notelaea venosa	2	0.35	3	0.59	negative
Oplismenus imbecillis	1	0.24	3	0.62	negative
Pittosporum undulatum	1	0.59	3	0.64	negative

MU2 Coachwood Warm Temperate Rainforest

❑ *DESCRIPTION*

Coachwood Warm Temperate Rainforest is a conspicuous feature of the upper escarpment slopes. It forms a dense closed canopy of *Ceratopetalum apetalum* and *Doryphora sassafras* that can reach heights up to 30 metres. *Acmena smithii* is a common associate species. Limited sunlight penetrates the canopy and as a consequence only a sparse understorey of shade tolerant species are present. These include ferns (*Lastreopsis decomposita*, *Microsorum scandens* and *Arthropteris tenella*), climbers (*Morinda jasminoides*) and palms (*Livistona australis*).

Coachwood Warm Temperate Rainforest occurs along the length of the escarpment, on Narrabeen geologies above 250 metres in elevation. It extends into the southern end of Royal National Park along the deepest and most sheltered gullies of the Hacking River. To the South it extends into Macquarie Pass National Park and into Shellharbour LGA (Mills, 2000). It is also prevalent in deep gullies on the Narrabeen Group Geologies in the Cataract, Cordeaux and Avon water catchments. Some variations do occur within this map unit in response to disturbance, rainfall and elevation. Greater elevation on the Woronora Plateau favours the growth of rainforest species associated with cool temperate environments. Mills & Jakeman (1995) note that *Quintinia sieberi* and *Eucryphia moorei* are restricted to the higher elevations, while species such as *Polyosma cunninghamii* and *Tasmannia insipida* are more frequent. These cool temperate influences within Coachwood Warm Temperate Rainforest appear in the Avon River and Upper Cordeaux Dam (Thomas, 1990). Heavily disturbed and regenerating rainforest environments in the Cordeaux and Cataract Catchments support sites of lower species diversity.

❑ *FLORISTIC SUMMARY*

Number of Sites: 10

Trees: 12-35m tall. Mean Projected Canopy Cover 75%

Ceratopetalum apetalum, Acmena smithii, Doryphora sassafras, Livistona australis, Cryptocarya glaucescens

Subcanopy Trees and Shrubs: 8-22m tall. Mean Projected Canopy Cover 25%

Tasmannia insipida, Pittosporum undulatum, Cyathea australis, Cyathea leichhardtiana, Synoum glandulosum subsp. *glandulosum, Notelaea venosa, Trochocarpa laurina, Eupomatia laurina, Polyosma cunninghamii, Callicoma serratifolia*

Ground Covers: 0-1m tall. Mean Projected Canopy Cover 25%

Blechnum cartilagineum, Arthropteris tenella, Asplenium flabellifolium, Lastreopsis decomposita, Gymnostachys anceps, Blechnum wattsii, Lomandra longifolia, Todea barbara, Calochlaena dubia, Microsorum spp., *Fieldia australis, Grammitis billardierei*

Vines & Climbers:

Palmeria scandens, Morinda jasminoides, Parsonsia straminea, Pandorea pandorana subsp. *pandorana, Smilax australis, Eustrephus latifolius, Marsdenia rostrata*

Epiphytes/lithophytes:

Asplenium australasicum, Pyrrosia rupestris

❑ *KEY IDENTIFYING FEATURES*

Easily recognisable features to assist in identifying this map unit are:

- A dense closed forest canopy dominated by Coachwood (*Ceratopetalum apetalum*) that may also contain Lilly pilly (*Acmena smithii*), Sassafras (*Doryphora sassafras*), and Jackwood (*Cryptocarya glaucescens*).
- Shrubs such as Pepper-bush (*Tasmannia insipida*), Bolwarra (*Eupomatia laurina*), Sweet pittosporum (*Pittosporum undulatum*) and Tree heath (*Trochocarpa laurina*).
- Predominance of rhizomatous fern species climbing on rocks, logs and tree trunks including *Microsorum* spp. and *Arthropteris tenella.*
- Presence of Anchor vine (*Palmeria scandens*).
- Presence of epiphytes and lithophytes such as Birds nest fern (*Asplenium australasicum*) and Rock felt fern (*Pyrrosia rupestris*).
- A high diversity of ferns and the presence of Gristle fern (*Blechnum cartilagineum*) and Shield fern (*Lastreopsis decomposita*).

❑ *EXAMPLE LOCATIONS*

Below Sublime Point and Bulli Lookouts; Bong Bong Pass; Kembla State Forest; Hargraves Creek, Stanwell Park; Stockyard Creek, Wombarra.

❑ *CONSERVATION STATUS*

RESERVATION STATUS

Tenure	Study Area (ha)	Proportion of Total (%)	Sydney Basin Bioregion (ha/%)
National Park Estate	695.51	30.3	700 (14)
Water Catchment	266.05	11.6	1380 (28)
State Forest	27.59	1.2	
Wollongong City Council Reserves	80.48	3.5	
Reserved Subtotal	1069.63	46.6	
Other	1224.32	53.4	
Total	2293.95	100	>5000

CONDITION ASSESSMENT

Disturbance Class	Area (ha)	Proportion Extant (%)
A Light	1498.97	65.3
B Moderate	467.40	20.4
C Heavy	326.99	14.3
Scattered trees	0.59	0.0
Total	2293.95	100

❑ *THREATENED PLANT SPECIES*

Haloragis exalata subsp. *exalata* var. *exalata* (V), *Sphaerocionium lyallii* (3R)

❑ *DIAGNOSTIC SPECIES*

Species Name	Group Score	Group Freq	Non Group Score	Non Group Freq	Fidelity Class
Acmena smithii	4	0.92	2	0.43	positive
Arthropteris tenella	2	0.83	2	0.19	positive
Asplenium australasicum forma australasicum	2	0.92	1	0.14	positive
Asplenium flabellifolium	2	0.50	2	0.36	positive
Blechnum cartilagineum	2	0.75	2	0.17	positive
Blechnum patersonii subsp. patersonii	2	0.50	3	0.02	positive
Bulbophyllum exiguum	1	0.08	0	0.00	positive
Ceratopetalum apetalum	5	1.00	4	0.11	positive
Cryptocarya glaucescens	2	0.67	4	0.25	positive
Cyathea leichhardtiana	4	0.67	2	0.03	positive
Dendrobium speciosum	1	0.08	0	0.00	positive
Dendrobium striolatum	1	0.08	0	0.00	positive
Doryphora sassafras	4	1.00	4	0.25	positive
Elaeocarpus kirtonii	2	0.08	0	0.00	positive
Elatostema reticulatum	4	0.08	0	0.00	positive
Eucryphia moorei	4	0.08	0	0.00	positive
Eupomatia laurina	2	0.67	2	0.31	positive
Lastreopsis decomposita	3	0.83	4	0.17	positive
Livistona australis	2	0.92	3	0.46	positive
Microsorum pustulatum subsp. pustulatum	3	0.50	1	0.02	positive
Microsorum scandens	2	0.58	3	0.14	positive
Morinda jasminoides	2	0.92	2	0.31	positive
Palmeria scandens	3	0.83	2	0.15	positive
Peperomia tetraphylla	1	0.08	0	0.00	positive
Polyosma cunninghamii	2	0.75	2	0.09	positive
Pyrrosia rupestris	2	0.75	2	0.21	positive
Sticherus urceolatus	2	0.08	0	0.00	positive
Syzygium oleosum	1	0.08	0	0.00	positive
Tasmannia insipida	2	0.75	2	0.03	positive
Geitonoplesium cymosum	1	0.33	2	0.66	negative
Oplismenus imbecillis	1	0.17	3	0.62	negative
Pseuderanthemum variabile	3	0.33	3	0.63	negative

MU3 Robertson Cool-Warm Temperate Rainforest

❑ *DESCRIPTION*

An isolated outcropping of Basalt at Macquarie Hill near Robertson supports regenerating rainforest that differs from that found on the escarpment slopes and plains. At this site, a canopy dominated by *Doryphora sassafras* and *Acmena smithii* is present in combination with *Polyosma cunninghamii* and *Quintinia sieberi* at lower abundance. *Ceratopetalum apetalum* is noticeably absent from this site. Low shrubs of *Coprosma quadrifida* and *Diospyros australis* are also present. The ground cover contains a sparse cover of ferns including *Lastreopsis microsora* and *Microsorum pustulatum* subsp. *pustulatum*. The height of this rainforest does not reach more than 12 metres, although some taller *Acacia melanoxylon* emerge through the rainforest layer.

The term Yarrawa Brush (Mills & Jakeman, 1995) has been used to describe a rainforest complex that is thought to have persisted across the basalt geologies of the Robertson district. Clearing of this rainforest has left few examples from which to develop a comprehensive floristic profile. The rainforest at Macquarie Hill is thought to maintain the north and eastern limit of this once extensive community (Thomas, 1990). Robertson Cool-Warm Temperate Rainforest is listed on Part 3 of Schedule 1 of the Threatened Species Conservation Act (1995) as an Endangered Ecological Community, under the name Robertson Rainforest.

❑ *FLORISTIC SUMMARY*

Number of Sites: 1

Emergent Trees: 16-18m tall. Mean Projected Canopy Cover 25%

Acacia melanoxylon

Trees: 8-12m tall. Mean Projected Canopy Cover 75%

Acmena smithii, Doryphora sassafras, Acacia melanoxylon

Subcanopy Trees and Shrubs: 1-2m tall. Mean Projected Canopy Cover 10%

Quintinia sieberi, Polyosma cunninghamii, Tasmannia insipida, Cyathea australis, Diospyros australis

Ground Covers: 0-1 m tall. Mean Projected Canopy Cover 10%

Blechnum patersonii subsp. *patersonii, Gymnostachys anceps, Microsorum pustulatum* subsp. *pustulatum, Fieldia australis*

Vines & Climbers:

Morinda jasminoides, Parsonsia straminea, Pandorea pandorana subsp. *pandorana, Eustrephus latifolius, Marsdenia rostrata*

Epiphytes/lithophytes:

Asplenium australasicum, Pyrrosia rupestris

❑ *KEY IDENTIFYING FEATURES*

Easily recognisable features to assist in identifying this map unit are:

- Basalt outcropping at Macquarie Hill.
- Dense canopy cover of Sassafras (*Doryphora sassafras*) and Lilly pilly (*Acmena smithii*).
- Species characteristic of cooler rainforest environments such as *Quintinia sieberi.*

❑ *EXAMPLE LOCATIONS*

Macquarie Hill

❑ *CONSERVATION STATUS*

Listed as an Endangered Ecological Community under Part 3 of Schedule 1 of the Threatened Species Conservation Act (1995).

RESERVATION STATUS

Tenure	Study Area (ha)	Proportion of Total (%)	Sydney Basin Bioregion (ha/%)
National Park Estate	1.69	15.2	6 (1)
Water Catchment	0	0	45 (8)
State Forest	0	0	
Wollongong City Council Reserves	0	0	
Reserved Subtotal	1.69	15.2	
Other	9.44	84.8	
Total	11.13	100	571

CONDITION ASSESSMENT

Disturbance Class	Area (ha)	Proportion Extant (%)
A Light	0	0
B Moderate	11.13	100
C Heavy	0	0
Scattered trees	0	0
Total	11.13	100

❑ *THREATENED PLANT SPECIES*

None recorded

❑ *DIAGNOSTIC SPECIES*

Species Name	Group Score	Group Freq	Non Group Score	Non Group Freq	Fidelity Class
Acacia melanoxylon	4	1	1	0.07	positive
Acmena smithii	6	1	2	0.45	positive
Asplenium australasicum forma australasicum	2	1	1	0.18	positive
Asplenium flabellifolium	3	1	2	0.36	positive
Blechnum patersonii subsp. patersonii	3	1	2	0.05	positive
Coprosma quadrifida	2	1	1	0.08	positive
Cyathea australis	3	1	1	0.12	positive
Diospyros australis	3	1	1	0.43	positive
Doryphora sassafras	5	1	4	0.29	positive

Species Name	Group Score	Group Freq	Non Group Score	Non Group Freq	Fidelity Class
Gymnostachys anceps	3	1	2	0.46	positive
Lastreopsis microsora subsp. microsora	3	1	4	0.01	positive
Libertia paniculata	2	1	0	0	positive
Microsorum pustulatum subsp. pustulatum	2	1	3	0.04	positive
Morinda jasminoides	2	1	2	0.35	positive
Pellaea nana	2	1	2	0.05	positive
Solanum prinophyllum	3	1	1	0.04	positive
Veronica plebeia	2	1	1	0.07	positive
Geitonoplesium cymosum	1	1	2	0.63	negative
Notelaea venosa	1	1	3	0.57	negative
Oplismenus imbecillis	1	1	3	0.58	negative
Pandorea pandorana subsp. pandorana	1	1	2	0.67	negative
Pittosporum undulatum	0	0	2	0.63	negative
Pseuderanthemum variabile	0	0	3	0.61	negative
Eustrephus latifolius	3	1	2	0.66	constant
Marsdenia rostrata	3	1	2	0.56	constant

MU4 Lowland Dry-Subtropical Rainforest

❑ *DESCRIPTION*

Lowland Dry-Subtropical Rainforest is a closed forest characterised by a low and dense canopy of species such as *Cassine australis* var. *australis, Alectryon subcinereus, Planchonella australis, Ficus rubiginosa, Geijera salicifolia* var. *latifolia, Alphitonia excelsa, Dendrocnide excelsa* and *Melia azedarach*. A layer of small trees such as *Streblus brunonianus* and *Notelaea venosa* is abundant and common to most sites. Unlike other rainforest in the district, it is rarely tall and may sometimes form low thick scrubs. A diversity of vines drape from the canopy above a sparse, rocky understorey. These include *Maclura cochinchinensis, Parsonsia straminea* and *Celastrus australis*. Ground cover includes a low abundance of ferns that include *Pellaea falcata, Doodia aspera* and *Asplenium flabellifolium*. Occasional emergent *Eucalyptus tereticornis* are present.

Lowland Dry-Subtropical Rainforest occupies fertile soils derived from volcanic sandstones and latites that occur south of Wollongong. Remnants are present on ridges above the coastal plain and on the escarpment foothills at elevations between 50 and 180 metres. It occurs in a number of topographic positions, from exposed slopes on rocky scree to dry gully lines. In deeper gully lines, the rainforest is taller and subtropical species become more pronounced. Typically *Dendrocnide excelsa* and *Toona australis* appear as characteristic canopy species. Future work may identify these variations within the LGA as separate communities. Several sites located on the Budgong sandstone of the Berkeley Hills grouped with sites describing this community. Mills & Jakeman (1995) termed the once extensive rainforest of this area as "Berkeley Brush". Two other important floristic variations are present within this Map Unit. The first occurs at Wollamai Point on Lake Illawarra where a dry/littoral rainforest occurs. The second is a dry/subtropical rainforest located behind Mt. Pleasant on a small Monchequite coal seam.

The species composition of Lowland Dry-Subtropical Rainforest differs greatly from other rainforests in the LGA. The influence of volcanic soils supports conditions for several species which are unique to this community whilst excluding others which are common to the rainforests found on sedimentary soils. *Ficus superba* var. *henneana, Cynanchum elegans, Austromyrtus acmenoides* are examples of the former and *Livistona australis,* and *Ceratopetalum apetalum* are examples of the latter.

Lowland Dry-Subtropical Rainforest extends into Shellharbour and Kiama LGAs along the footslopes of the escarpment. The community is not present elsewhere in the region. Sites describing coastal dry rainforest types in Western Sydney and the Lower Hunter Valley are more depauperate and lack the distinctly subtropical influences present in the Illawarra. It is recognised (Mills, 1995; NPWS, 2000b) that the rainforests of the coastal lowlands have been extensively cleared. Within the Study Area much of the remaining distribution displays evidence of heavy disturbance resulting in infestations of *Lantana camara*.

Lowland Dry-Subtropical Rainforest forms a component of Illawarra Subtropical Rainforest, an Endangered Ecological Community listed under the Threatened Species Act (1995).

❑ *FLORISTIC SUMMARY*

Number of Sites: 11

Emergent Trees: 17-25m tall. Mean Projected Canopy Cover 25%

Ficus rubiginosa, Ficus superba var. *henneana, Eucalyptus tereticornis, Toona australis, Dendrocnide excelsa*

Trees: 7-12m tall. Mean Projected Canopy Cover 70%

Cassine australis var. *australis, Streblus brunonianus, Notelaea venosa, Croton verreauxii, Alectryon subcinereus, Planchonella australis, Acacia maidenii, Rapanea variabilis, Clerodendrum tomentosa, Diospyros australis, Diospyros pentamera, Alphitonia excelsa, Backhousia myrtifolia, Pittosporum undulatum, Melicope micrococca, Callistemon salignus, Geijera salicifolia* var. *latifolia, Melia azedarach*

Shrubs: 2-6m tall. Mean Projected Canopy Cover 35%

Pittosporum multiflorum, Alchornea ilicifolia, Breynia oblongifolia, Pittosporum revolutum, Abutilon oxycarpum

Ground Covers: 0-1m tall. Mean Projected Canopy Cover 25%

Pseuderanthemum variabile, Oplismenus imbecillis, Pellaea falcata, Asplenium flabellifolium, Doodia aspera, Nyssanthes spp., *Gymnostachys anceps, Carex longebrachiata, Commelina cyanea, Dichondra repens*

Vines & Climbers:

Geitonoplesium cymosum, Pandorea pandorana subsp. *pandorana, Eustrephus latifolia, Parsonsia straminea, Maclura cochinchinensis, Cayratia clematidea, Marsdenia rostrata, Aphanopetalum resinosum, Stephania japonica* var. *discolor, Celastrus australis, Cynanchum elegans*

❑ *KEY IDENTIFYING FEATURES*

Easily recognisable features to assist in identifying this map unit are:

- A very dense and often low tree canopy dominated by combinations of the following: Red olive plum (*Cassine australis* var. *australis*), Whalebone tree (*Streblus brunonianus*), Smooth m ock olive (*Notelaea venosa*), Native cascarilla (*Croton verreauxii*), Wild quince (*Alectryon subcinereus*) and Black apple (*Planchonella australis*).
- The presence of uncomm on dry rainfo rest species such as Bauerella (*Sarcomelicope simplicifolia* subsp. *simplicifolia*), Scrub ironwood (*Austromyrtus acmenoides*) and Decid uous fig (*Ficus superba* var. *henneana*).
- A sparse u nderstorey comprising species such as Orange thorn (*Pittosporum multiflorum*), Small-flowered abutilon (*Abutilon oxycarpum*), *Pseuderanthemum variabile, Oplismenus imbecillis*, Necklace fern (*Asplenium flabellifolium*), Rasp fern (*Doodia aspera*) and Sickle fern (*Pellaea falcata*)
- An abundance of vines/lianes

❑ *EXAMPLE LOCATIONS*

Mt.Brown, Dapto; Berkeley Hills; Marshall Mount; Calderwood; Avondale.

❑ *CONSERVATION STATUS*

Listed as an Endangered Ecological Community under Part 3 of Schedule 1 of the Threatened Species Conservation Act (1995).

RESERVATION STATUS

Tenure	Study Area (ha)	Proportion of Total (%)	Sydney Basin Bioregion (ha/%)
National Park Estate	51.09	11.1	51 (2.5)
Water Catchment	0	0	
State Forest	0	0	
Wollongong City Council Reserves	14.55	3.2	
Reserved Subtotal	65.64	14.3	
Other	395.48	85.8	
Total	461.12	100	2079

CONDITION ASSESSMENT

Disturbance Class	Area (ha)	Proportion Extant (%)
A Light	60.72	13.2
B Moderate	201.42	43.7
C Heavy	198.98	43.2
Scattered trees	0	0
Total	461.12	100

❑ *THREATENED PLANT SPECIES*

Cynanchum elegans (E1), *Daphnandra* sp. "Illawarra" (E1), *Haloragis exalata* subsp. *exalata* var. *laevis* (V)

❑ *DIAGNOSTIC SPECIES*

Species Name	Group Score	Group Freq	Non Group Score	Non Group Freq	Fidelity Class
Abutilon oxycarpum var. oxycarpum	1	0.09	0	0.00	positive
Actephila lindleyi	2	0.09	0	0.00	positive
Alectryon subcinereus	4	0.82	1	0.25	positive
Aphanopetalum resinosum	3	0.55	2	0.09	positive
Asplenium flabellifolium	3	0.73	2	0.35	positive
Austromyrtus acmenoides	1	0.09	0	0.00	positive
Cassine australis var. australis	4	1.00	3	0.35	positive
Cayratia clematidea	2	0.55	1	0.24	positive
Celastrus australis	3	0.55	2	0.04	positive
Croton verreauxii	3	0.82	3	0.23	positive
Diospyros australis	4	0.91	1	0.40	positive
Diospyros pentamera	1	0.09	0	0.00	positive
Doodia aspera	3	0.55	3	0.46	positive
Ficus superba var. henneana	5	0.09	0	0.00	positive
Gymnostachys anceps	2	0.73	2	0.46	positive
Maclura cochinchinensis	2	0.73	1	0.15	positive
Melicope micrococca	2	0.64	1	0.15	positive
Parsonsia straminea	2	0.82	1	0.33	positive
Pellaea falcata	3	0.64	2	0.28	positive

Species Name	Group Score	Group Freq	Non Group Score	Non Group Freq	Fidelity Class
Pittosporum multiflorum	3	0.91	2	0.34	positive
Planchonella australis	4	0.73	4	0.10	positive
Pollia crispata	2	0.09	0	0.00	positive
Streblus brunonianus	5	1.00	1	0.22	positive
Eustrephus latifolius	1	0.91	2	0.65	negative
Livistona australis	0	0.00	2	0.52	negative
Pittosporum undulatum	1	0.82	3	0.62	negative
Marsdenia rostrata	2	0.36	2	0.59	negative
Geitonoplesium cymosum	2	0.91	2	0.67	constant
Notelaea venosa	4	0.73	2	0.56	constant
Oplismenus imbecillis	3	0.91	3	0.57	constant
Pandorea pandorana subsp. pandorana	2	1.00	2	0.67	constant
Pseuderanthemum variabile	3	0.91	3	0.59	constant

MU5 Littoral Windshear Thicket

❑ *DESCRIPTION*

Littoral Windshear Thicket is a form of littoral rainforest. It occurs amongst a complex of vegetation occurring on clay soils on sheltered headlands, cliffs and gullylines approaching the ocean. As the name suggests, Littoral Windshear Thicket is exposed to buffeting salt laden winds forming a dense, close cropped thicket of rainforest trees. It is found north from Austinmer and extends into the Royal National Park on headlands underlain by Narrabeen Group geologies.

The height of the rainforest canopy rarely exceeds ten metres. The canopy is dominated by *Acmena smithii*, *Cassine australis* var. *australis*, *Guioa semiglauca, Diospyros australis*, *Ficus rubiginosa*, *F. obliqua* var. *obliqua* and *Banksia integrifolia* subsp. *integrifolia*. *Livistona australis* is present in sheltered aspects such as Palm Jungle near Burning Palms in Royal National Park. The understorey is characterised by a tangle of vines and twisted tree trunks and limbs reaching over a range of shade tolerant herbs and ferns. These include *Viola hederacea, Dichondra repens, Doodia aspera* and *Pellaea falcata*. Vines and twiners include *Sarcopetalum harveyanum* and *Eustrephus latifolius*. Emergent trees of *Eucalyptus botryoides* are sometimes present.

Headlands are a feature of the coastline of the Sydney Basin Bioregion. Pockets of similar rainforest extend along this area although floristic composition changes in response to latitudinal variation. North of the Illawarra, *Cupaniopsis anacardioides* is a prominent feature amongst an otherwise similar floristic composition. Adam *et al.* (1989) describes seacliff vegetation with a rainforest influence, that contains may of the species found in Littoral Windshear Thicket. Headland development has led to the depletion of Littoral Rainforests across their range.

❑ *FLORISTIC SUMMARY*

Number of Sites: 4

Emergent trees: 15-20m tall. Mean Projected Canopy Cover 7%

Eucalyptus botryoides

Trees: 1-10m tall. Mean Projected Canopy Cover 80%

Cassine australis var. *australis, Acmena smithii, Guioa semiglauca, Diospyros australis, Ficus rubiginosa, Ficus obliqua* var. *obliqua, Banksia integrifolia* subsp. *integrifolia, Pittosporum undulatum*

Ground Covers: 0-1m tall. Mean Projected Canopy Cover 25%

Oplismenus imbecillis, Pseuderanthemum variabile, Lomandra longifolia, Asplenium flabellifolium, Doodia aspera, Viola hederacea, Gymnostachys anceps, Dichondra repens, Pellaea falcata

Vines & Climbers:

Geitonoplesium cymosum, Eustrephus latifolius, Smilax australis, Cissus antarctica, Marsdenia rostrata, Sarcopetalum harveyanum

❑ *KEY IDENTIFYING FEATURES*

Easily recognisable features to assist in identifying this map unit are:

- Restricted to sheltered locations on clay headlands and cliff faces in close proximity to the ocean.
- A low to very low clo sed forest structure often exhibiting windshear, the canopy comp rising a combination of species such as Red olive plum (*Cassine australis* var. *australis*), Lilly pilly (*Acmena smithii*), Guioa (*Guioa semiglauca*), Black plum (*Diospyros australis*), Coast banksia (*Banksia integrifolia* subsp. *integrifolia*) and often with Bangalay (*Eucalyptus botryoides*).
- An understorey including *Oplismenus imbecillis*, *Pseuderanthemum variabile*, Rasp fern (*Doodia aspera*), Sickle fern (*Pellaea falcata*), Native violet (*Viola hederacea*) and Kid ney weed (*Dichondra repens*).

❑ *EXAMPLE LOCATIONS*

Bulgo, Burning Palms, Garie, Werrong and Marley in Royal NP; Clifton; Coalcliff; Col edale Hospital, Scarborough.

❑ *CONSERVATION STATUS*

RESERVATION STATUS

Tenure	Study Area (ha)	Proportion of Total (%)	Sydney Basin Bioregion (ha/%)
National Park Estate	31.40	45.4	55 (59)
Water Catchment	0	0	
State Forest	0	0	
Wollongong City Council Reserves	6.66	9.6	
Reserved Subtotal	38.06	55.0	
Other	31.15	45.0	
Total	69.21	100	93

CONDITION ASSESSMENT

Disturbance Class	Area (ha)	Proportion Extant (%)
A Light	19.36	28.0
B Moderate	26.33	38.0
C Heavy	23.39	33.8
Scattered trees	0.13	0.2
Total	69.21	100

❑ *THREATENED PLANT SPECIES*

None recorded

❑ *DIAGNOSTIC SPECIES*

Species Name	Group Score	Group Freq	Non Group Score	Non Group Freq	Fidelity Class
Acmena smithii	4	1.00	2	0.45	positive
Asplenium flabellifolium	4	1.00	2	0.36	positive
Banksia integrifolia subsp. integrifolia	4	0.50	4	0.08	positive
Cassine australis var. australis	4	0.50	3	0.39	positive
Cissus antarctica	2	0.75	2	0.13	positive
Clerodendrum tomentosum	2	0.75	1	0.42	positive

Species Name	Group Score	Group Freq	Non Group Score	Non Group Freq	Fidelity Class
Dichondra repens	3	0.75	3	0.33	positive
Diospyros australis	4	0.75	1	0.43	positive
Doodia aspera	3	0.75	3	0.46	positive
Entolasia marginata	2	0.50	2	0.24	positive
Eucalyptus botryoides	4	0.50	4	0.14	positive
Eupomatia laurina	3	0.50	2	0.33	positive
Ficus rubiginosa	6	0.50	1	0.03	positive
Gahnia melanocarpa	2	0.50	2	0.11	positive
Guioa semiglauca	5	1.00	1	0.19	positive
Gymnostachys anceps	2	0.75	2	0.47	positive
Hibbertia scandens	2	0.50	1	0.20	positive
Livistona australis	3	0.75	2	0.48	positive
Pellaea falcata	2	0.50	2	0.30	positive
Pittosporum revolutum	2	0.75	1	0.38	positive
Poa labillardieri var. labillardieri	2	0.50	3	0.28	positive
Rapanea howittiana	4	0.50	1	0.04	positive
Rapanea variabilis	2	0.75	2	0.37	positive
Sarcopetalum harveyanum	2	1.00	1	0.14	positive
Scolopia braunii	2	0.75	1	0.05	positive
Smilax australis	2	0.75	2	0.45	positive
Synoum glandulosum subsp. glandulosum	3	0.75	2	0.39	positive
Viola hederacea	4	0.50	2	0.13	positive
Wilkiea huegeliana	4	0.50	2	0.18	positive
Notelaea venosa	3	0.25	3	0.58	negative
Eustrephus latifolius	2	0.75	2	0.66	constant
Geitonoplesium cymosum	2	1.00	2	0.63	constant
Marsdenia rostrata	2	0.50	2	0.57	constant
Oplismenus imbecillis	3	1.00	3	0.58	constant
Pandorea pandorana subsp. pandorana	3	0.50	2	0.64	constant
Pittosporum undulatum	4	1.00	2	0.62	constant
Pseuderanthemum variabile	3	1.00	3	0.60	constant

MU6 Hind-Dune Littoral Rainforest

❑ *DESCRIPTION*

Hind-Dune Littoral Rainforest occurs on protected swales and depressions behind sand dune systems along the coastline. It is a low closed forest (generally to fifteen metres in height) with emergent Eucalypts (*E. botryoides, E. robusta*) and a rainforest subcanopy dominated by *Endiandra sieberi*, *Pittosporum undulatum, Podocarpus elatus, Acronychia oblongifolia* and *Planchonella australis*. Analysis of site data indicated that floristic differences with Map Unit 5 Littoral Windshear Thicket are subtle. Many species are shared between the two communities including *Acmena smithii, Banksia integrifolia* subsp. *integrifolia, Guioa semiglauca, Rapanea* spp., *Pittosporum* spp., *Asplenium flabellifolium, Doodia aspera* and *Viola hederacea*. However, species such as *Podocarpus elatus* and *Celtis paniculata* favour the unconsolidated sand deposits of the Windang Peninsula and Lake Illawarra islands.

In Wollongong LGA, most sheltered hind-dune areas have been cleared for urban development and sand mining. Small areas of vegetated coastal dune systems still exist at Windang, Towradgi and Bellambi. Hind-Dune Littoral Rainforest aligns to Suballiance 20 in Floyd (1990) statewide rainforest classification. Mills (2000) describes a similar community for the Bass Point and Minnamurra Spit in Shellharbour LGA. Both recognise the extent of past depletion and limited protection in formal reserves within both the region and state.

Hind-Dune Littoral Rainforest is susceptible to chronic infestation by the weeds Bitou bush (*Chrysanthemoides monilifera* subsp. *rotundata*), Cape Ivy (*Deliria odorata*) and Asparagus ferns (*Protasparagus* spp.).

❑ *FLORISTIC SUMMARY*

Number of Sites: 2

Emergent trees: 15-20m tall. Mean Projected Canopy Cover 7%

Eucalyptus botryoides, Eucalyptus robusta

Trees: 8-12m tall. Mean Projected Canopy Cover 70%

Endiandra sieberi, Pittosporum undulatum, Planchonella australis, Acmena smithii, Guioa semiglauca, Rapanea variabilis, Acronychia oblongifolia, Alphitonia excelsa, Podocarpus elatus, Celtis paniculata, and less commonly *Banksia integrifolia* subsp. *integrifolia, Canthium coprosmoides, Pararchidendron pruinosum* var. *pruinosum, Euroschinus falcata* var. *falcata*

Shrubs: 1-10m tall. Mean Projected Canopy Cover 15%

Breynia oblongifolia, Clerodendrum tomentosum, Notelaea venosa, Pittosporum revolutum

Ground Covers: 0-1m tall. Mean Projected Canopy Cover 45%

Commelina cyanea, Oplismenus imbecillis, Lomandra longifolia, Pellaea falcata, Asplenium flabellifolium, Doodia aspera, Viola hederacea

Vines & Climbers:

Geitonoplesium cymosum, Cayratia clematidea, Maclura cochinchinensis, Marsdenia rostrata, Smilax glyciphylla

❑ *KEY IDENTIFYING FEATURES*

Easily recognisable features to assist in identifying this map unit are:

- Located in sheltered areas behind coastal sand dunes.
- Often an emergent eucalypt layer comprising Bangalay (*Eucalyptus botryoides*) and less commonly Swamp mahogany (*E. robusta*).
- A dominant canopy comprising species such as Corkwood (*Endiandra sieberi*), Sweet pittosporum (*Pittosporum undulatum*), Plum pine (*Podocarpus elatus*), Common acronychia (*Acronychia oblongifolia*) and Black apple (*Planchonella australis*).

❑ *EXAMPLE LOCATIONS*

Windang; Korrongulla wetland; Puckeys Estate

❑ *CONSERVATION STATUS*

RESERVATION STATUS

Tenure	Study Area (ha)	Proportion of Total (%)	Sydney Basin Bioregion (ha/%)
National Park Estate	0	0	N/A
Water Catchment	0	0	
State Forest	0	0	
Wollongong City Council Reserves	1.55	82.0	
Reserved Subtotal	1.55	82.0	
Other	0.34	18.0	
Total	1.89	100	

CONDITION ASSESSMENT

Disturbance Class	Area (ha)	Proportion Extant (%)
A Light	0	0
B Moderate	0.04	2.1
C Heavy	1.85	97.9
Scattered trees	0	0
Total	1.89	100

❑ *THREATENED PLANT SPECIES*

None recorded

❑ *DIAGNOSTIC SPECIES*

Species Name	Group Score	Group Freq	Non Group Score	Non Group Freq	Fidelity Class
Acronychia oblongifolia	4	0.50	2	0.10	positive
Alphitonia excelsa	4	0.50	1	0.18	positive
Asplenium flabellifolium	4	0.50	2	0.37	positive
Breynia oblongifolia	3	1.00	1	0.38	positive
Cayratia clematidea	3	0.50	2	0.26	positive
Celtis paniculata	1	0.50	0	0.00	positive
Cissus antarctica	2	0.50	2	0.14	positive
Clerodendrum tomentosum	3	1.00	1	0.42	positive
Commelina cyanea	3	1.00	2	0.32	positive
Doodia aspera	3	0.50	3	0.46	positive
Duboisia myoporoides	2	0.50	1	0.02	positive
Endiandra sieberi	5	1.00	4	0.02	positive
Eucalyptus botryoides	4	0.50	4	0.15	positive
Eucalyptus robusta	4	0.50	4	0.03	positive
Guioa semiglauca	2	1.00	1	0.19	positive
Maclura cochinchinensis	3	0.50	2	0.18	positive
Pellaea falcata	2	1.00	2	0.29	positive
Phyllanthus gunnii	2	0.50	2	0.02	positive
Pittosporum revolutum	2	1.00	1	0.38	positive
Planchonella australis	4	1.00	4	0.13	positive
Podocarpus elatus	4	0.50	2	0.03	positive
Rapanea variabilis	2	1.00	2	0.37	positive
Scolopia braunii	2	0.50	2	0.06	positive
Smilax glyciphylla	3	0.50	2	0.09	positive
Trophis scandens subsp. scandens	2	0.50	2	0.08	positive

Species Name	Group Score	Group Freq	Non Group Score	Non Group Freq	Fidelity Class
Viola hederacea	4	0.50	2	0.13	positive
Zieria smithii	2	0.50	2	0.06	positive
Eustrephus latifolius	0	0.00	2	0.68	negative
Pandorea pandorana subsp. pandorana	0	0.00	2	0.65	negative
Geitonoplesium cymosum	2	1.00	2	0.63	constant
Marsdenia rostrata	3	0.50	2	0.57	constant
Notelaea venosa	3	1.00	3	0.57	constant
Oplismenus imbecillis	4	1.00	3	0.58	constant
Pittosporum undulatum	5	1.00	2	0.62	constant
Pseuderanthemum variabile	2	0.50	3	0.61	constant

MU7 Cliffline Coachwood Scrub

❑ *DESCRIPTION*

A stunted mesic scrub occurs under the shadows of cliffs at the top of the escarpment slopes. Dominated by *Ceratopetalum apetalum,* this scrub includes species common to the Illawarra Escarpment Subtropical Rainforest downslope in combination with species common to the sandstone plateau above. Species such as *Doryphora sassafras, Banksia serrata, Tristaniopsis collina, Epacris longiflora* and *Polyosma cunninghamii* occur in unique combinations in these highly exposed environments. At Bong Bong Pass at 490 metres elevation, *Quintinia sieberi* occurs in the canopy indicating cool temperate influences to the composition of the community. Cliffline Coachwood Scrubs extend along the length of the escarpment and minor floristic variations occur as elevation changes between the north and the south of the LGA.

These scrubs share strong floristic relationships with riparian scrubs found in dissected sandstone gullies west of the escarpment in O'Hares Creek and Woronora Catchments.

❑ *FLORISTIC SUMMARY*

Number of Sites: 2

Trees: 2-12m tall. Mean Projected Canopy Cover 78%

Ceratopetalum apetalum, Banksia serrata, Quintinia sieberi, Pittosporum undulatum, Acmena smithii

Shrubs: 1-3m tall. Mean Projected Canopy Cover 30%

Tristaniopsis collina, Leucopogon lanceolatus var. *lanceolatus, Daviesia alata, Coprosma quadrifida*

Ground Covers: 0-1 m tall. Mean Projected Canopy Cover 18%

Gleichenia microphylla, Tasmannia insipida, Lepidosperma laterale, Lomandra longifolia

Vines & Climbers:

Parsonsia straminea, Smilax glyciphylla

❑ *KEY IDENTIFYING FEATURES*

Easily recognisable features to assist in identifying this map unit are:

- Stunted rainforest scrub rarely taller than 6-8 metres beneath escarpment cliffs.
- Dominance of Coachwood (*Ceratopetalum apetalum*).

❑ *EXAMPLE LOCATIONS*

Bong Bong Pass; Scarborough Cliff Top.

❑ *CONSERVATION STATUS*

RESERVATION STATUS

Tenure	Study Area (ha)	Proportion of Total (%)	Sydney Basin Bioregion (ha/%)
National Park Estate	6.88	12.7	8 (6)
Water Catchment	0.57	1.1	2 (2)
State Forest	0	0	
Wollongong City Council Reserves	1.50	2.8	
Reserved Subtotal	8.95	16.5	
Other	45.14	83.5	
Total	54.09	100	>125

CONDITION ASSESSMENT

Disturbance Class	Area (ha)	Proportion Extant (%)
A Light	54.09	100
B Moderate	0	0
C Heavy	0	0
Scattered trees	0	0
Total	54.09	100

❑ *THREATENED PLANT SPECIES*

None recorded

❑ *DIAGNOSTIC SPECIES*

Species Name	Group Score	Group Freq	Non Group Score	Non Group Freq	Fidelity Class
Asplenium flabellifolium	2	1.00	2	0.36	positive
Banksia serrata	2	0.50	2	0.03	positive
Blechnum wattsii	4	0.50	3	0.02	positive
Ceratopetalum apetalum	7	1.00	4	0.16	positive
Daviesia alata	1	1.00	0	0.00	positive
Dianella caerulea	2	0.50	1	0.26	positive
Epacris longiflora	2	0.50	3	0.01	positive
Fieldia australis	3	0.50	2	0.02	positive
Gahnia aspera	2	0.50	2	0.05	positive
Gleichenia microphylla	4	0.50	0	0.00	positive
Grammitis billardierei	2	1.00	0	0.00	positive
Histiopteris incisa	1	0.50	0	0.00	positive
Lastreopsis decomposita	2	0.50	3	0.21	positive
Lepidosperma laterale	3	0.50	2	0.14	positive
Leucopogon lanceolatus var. lanceolatus	2	1.00	2	0.06	positive
Lomandra longifolia	2	1.00	2	0.45	positive
Morinda jasminoides	2	0.50	2	0.35	positive
Olearia elliptica subsp. elliptica	2	0.50	0	0.00	positive
Persoonia pinifolia	1	0.50	0	0.00	positive
Polyosma cunninghamii	3	0.50	2	0.13	positive
Prostanthera incisa	1	0.50	0	0.00	positive
Pyrrosia rupestris	2	1.00	2	0.24	positive

Species Name	Group Score	Group Freq	Non Group Score	Non Group Freq	Fidelity Class
Quintinia sieberi	4	0.50	1	0.01	positive
Smilax glyciphylla	3	1.00	2	0.09	positive
Stenocarpus salignus	2	0.50	1	0.13	positive
Sticherus flabellatus var. flabellatus	3	0.50	4	0.01	positive
Tasmannia insipida	4	1.00	2	0.06	positive
Todea barbara	4	0.50	3	0.01	positive
Tristaniopsis collina	4	0.50	3	0.07	positive
Trochocarpa laurina	2	0.50	1	0.10	positive
Eustrephus latifolius	1	0.50	2	0.67	negative
Geitonoplesium cymosum	1	1.00	2	0.63	negative
Marsdenia rostrata	1	0.50	2	0.58	negative
Oplismenus imbecillis	0	0.00	3	0.59	negative
Pandorea pandorana subsp. pandorana	1	0.50	2	0.65	negative
Pseuderanthemum variabile	0	0.00	3	0.62	negative

MU8 Escarpment Moist Blue Gum Forest

❑ *DESCRIPTION*

Escarpment Moist Blue Gum Forest is a very tall Eucalypt forest with a prominent subcanopy of rainforest trees and mesic shrubs. The canopy is dominated by Blue Gums (*Eucalyptus salignaXbotryoides, E. saligna*) with co-dominant species that include *E. quadrangulata, Syncarpia glomulifera* subsp. *glomulifera* and *E. pilularis*. The rainforest subcanopy is tall, attaining heights of twenty metres. The rainforest trees present include subtropical influences such as *Diploglottis australis* and *Toona ciliata* as well as typical warm temperate species such as *Acmena smithii, Cryptocarya* spp., *Doryphora sassafras* and the palm *Livistona australis*. Shade tolerant ferns such as *Doodia aspera, Adiantum* spp. and *Calochlaena dubia* provide a low cover across the forest floor. Escarpment Moist Blue Gum Forest is closely related to Moist Coastal White Box Forest that dominates south of Mt. Kembla. Generally these wet Eucalypt forests grade into Illawarra Escarpment Subtropical Rainforests where shelter is greatest.

Escarpment Moist Blue Gum Forest occurs on escarpment slopes, benches and in moist gullies where combinations of deep soil, high rainfall and protected aspects prevail. It occurs primarily north of Mount Kembla on Illawarra Coal Measures or Narrabeen Group geologies at elevations between 60 and 300 metres. It is also present in the deeper gullies on Shoalhaven Group Shales and siltstones underlying Mangerton Park.

Two sites sampling the alluvial soils on the Hacking River in Royal National Park were closely related to the Moist Blue Gum Forest found on the escarpment. However, in the Royal National Park this community only develops as narrow ribbons along deep gullies at the interface between rainforest and eucalypt forest types. Sites describing Blue Gum Forests present within the water catchment on the plateau between Mt. Kembla and Mt. Keira grouped independently of those describing this community (refer to MU11 Moist Blue Gum-Blackbutt Forest).

South of the Wollongong LGA, the community appears to be a prominent feature of the lower escarpment slopes between Kiama and the Shoalhaven River. Similar landscape and climatic features occur in the Watagan Ranges between the Central Coast and Newcastle and in the northern suburbs of Sydney. Despite similarities in forest structure and habitat, floristic composition was sufficiently different from Escarpment Moist Blue Gum Forest to conclude that these communities are separate floristic assemblages.

❑ *FLORISTIC SUMMARY*

Number of Sites: 12

Trees: 10-35m tall. Mean Projected Canopy Cover 41%

Eucalyptus salignaXbotryoides, Eucalyptus quadrangulata, Eucalyptus pilularis, Syncarpia glomulifera subsp. *glomulifera*

Subcanopy Trees: 1-24m tall. Mean Projected Canopy Cover 60%

Acmena smithii, Livistona australis, Pittosporum undulatum, Cryptocarya glaucescens, Eupomatia laurina, Doryphora sassafras, Cryptocarya microneura, Claoxylon australe, Diospyros australis, Acacia maidenii, Diploglottis australis, Toona australis

Tall Shrubs: 1-14m tall. Mean Projected Canopy Cover 34%

Notelaea venosa, Clerodendrum tomentosum, *Synoum glandulosum* subsp. *glandulosum, Ficus coronata, Omalanthus populifolius, Rhodamnia rubescens*

Ground Covers: 0-1.5m tall. Mean Projected Canopy Cover 40%

Adiantum formosum, Pseuderanthemum variabile, Calochlaena dubia, Gymnostachys anceps, Oplismenus imbecillis, Asplenium flabellifolium, Pellaea falcata, Dichondra repens, Blechnum cartilagineum

Vines & Climbers:

Marsdenia rostrata, Celastrus subspicata, Eustrephus latifolius, Pandorea pandorana subsp. *pandorana, Geitonoplesium cymosum, Stephania japonica* var. *discolor, Tylophora barbata, Morinda jasminoides, Cayratia clematidea, Sarcopetalum harveyanum*

❑ *KEY IDENTIFYING FEATURES*

Easily recognisable features to assist in identifying this map unit are:

- A tall forest canopy comprising Blue gum (*E. saligna*) and/or Blue gum-Bangalay Hybrid (*Eucalyptus salignaXbotryoides*) with various co-dominant trees.
- A dense mesic subcanopy tree/ shrub layer comprising species such as Lilly pilly (*Acmena smithii*), Cabbage tree palm (*Livistona australis*), Sweet pittosporum (*Pittosporum undulatum*), Jackwood (*Cryptocarya glaucescens*), Bolwarra (*Eupomatia laurina*) and Sassafrass (*Doryphora sassafras*).
- A ferny understorey containing species such as Giant Maidenhair (*Adiantum formosum*), Common ground fern (*Calochlaena dubia*) and *Pseuderanthemum variabile.*
- A high abundance of vines and climbers particularly Common milk vine (*Marsdenia rostrata*) and Staff vine (*Celastrus subspicata*).

❑ *EXAMPLE LOCATIONS*

Buttenshaw Drive and Gibson Track, Austinmer; Rixons Pass; Bulli Pass; Kembla Heights; Mount Pleasant; Mangerton Park.

❑ *CONSERVATION STATUS*

RESERVATION STATUS

Tenure	Study Area (ha)	Proportion of Total (%)	Sydney Basin Bioregion (ha/%)
National Park Estate	214.04	35.2	1055 (8)
Water Catchment	0	0	
State Forest	0	0	
Wollongong City Council Reserves	29.30	4.8	
Reserved Subtotal	243.34	40.0	
Other	364.68	60.0	
Total	608.02	100	12506

CONDITION ASSESSMENT

Disturbance Class	Area (ha)	Proportion Extant (%)
A Light	149.19	24.5
B Moderate	203.89	33.5
C Heavy	193.17	31.8
Scattered trees	61.77	10.2
Total	608.02	100

❑ *THREATENED PLANT SPECIES*

None recorded

❑ *DIAGNOSTIC SPECIES*

Species Name	Group Score	Group Freq	Non Group Score	Non Group Freq	Fidelity Class
Acacia maidenii	2	0.62	1	0.38	positive
Acmena smithii	4	0.85	2	0.44	positive
Adiantum formosum	4	1.00	3	0.26	positive
Asplenium flabellifolium	2	0.54	2	0.36	positive
Calochlaena dubia	3	0.54	3	0.19	positive
Cassine australis var. australis	2	0.54	3	0.38	positive
Cryptocarya glaucescens	4	0.77	4	0.24	positive
Cryptocarya microneura	4	0.62	3	0.28	positive
Dichondra repens	2	0.62	3	0.32	positive
Doodia aspera	3	1.00	3	0.43	positive
Doryphora sassafras	4	0.54	4	0.28	positive
Eucalyptus saligna X botryoides	4	0.85	4	0.05	positive
Eupomatia laurina	3	0.77	2	0.30	positive
Gymnostachys anceps	2	0.92	2	0.44	positive
Hymenosporum flavum	1	0.08	0	0.00	positive
Livistona australis	4	0.77	2	0.47	positive
Melicope micrococca	2	0.54	1	0.16	positive
Pellaea falcata	2	0.85	2	0.26	positive
Pittosporum revolutum	2	0.62	1	0.37	positive
Smilax australis	3	1.00	2	0.42	positive
Synoum glandulosum subsp. glandulosum	2	0.77	2	0.37	positive
Tylophora barbata	2	0.54	2	0.33	positive
Geitonoplesium cymosum	1	0.85	2	0.62	negative
Eustrephus latifolius	2	1.00	2	0.64	constant
Marsdenia rostrata	3	0.92	2	0.54	constant
Notelaea venosa	2	1.00	3	0.54	constant
Oplismenus imbecillis	2	0.92	3	0.56	constant
Pandorea pandorana subsp. pandorana	2	0.83	2	0.66	constant
Pittosporum undulatum	3	0.92	2	0.61	constant
Pseuderanthemum variabile	3	1.00	3	0.58	constant

MU9 Moist Coastal White Box Forest

❑ *DESCRIPTION*

Moist Coastal White Box Forest is a tall mesic Eucalypt forest dominated by *Eucalyptus quadrangulata*. This community shares a similar structure and floristic composition to Escarpment Moist Blue Gum Forest. The eucalypt canopy is often taller than 30 metres, emerging above a dense rainforest subcanopy. Several layers of rainforest trees and shrubs are present and include species characteristic of warm-temperate-subtropical rainforests of the region such as *Diploglottis australis, Livistona australis, Dendrocnide excelsa, Toona australis, Cryptocarya microneura* and *Doryphora sassafras*. In addition species characteristic of dry rainforests such as *Cassine australis* var. *australis, Streblus brunonianus, Guioa semiglauca* and *Alectryon subcinereus* are common subdominants. The shaded understorey supports a profusion of vines and a ferny ground layer.

Moist Coastal White Box Forest occurs on mid to lower escarpment slopes between 110 and 300 metres elevation. It is most prominent southwards from Mount Kembla on the Illawarra Coal Measures, Quaternary Talus and Permian shales and siltstones. It is a feature of gully systems in the Calderwood Valley area.

The occurrence of *E. quadrangulata* as a canopy dominant above a mature Warm Temperate-Subtropical rainforest subcanopy appears restricted to the escarpment slopes of the Wollongong area. A similar community is not described by NPWS (2000a) for the south coast region. Mills (2000) describes a White Box-Yellow Stringybark Forest in the Shellharbour LGA that occupies similar habitat. However the distinctive rainforest subcanopy is not described. It is not known how extensive this community is along the escarpment of the LGA's of Kiama and Shoalhaven. In addition, no floristic similarities were achieved with sites from Royal National Park, Western Sydney, the Lower Hunter and Central Coast or the water catchments on the Woronora Plateau.

❑ *FLORISTIC SUMMARY*

Number of Sites: 11

Emergent Trees: 20-35m tall. Mean Projected Canopy Cover 10%

Eucalyptus quadrangulata, and occasionally *Eucalyptus cypellocarpa, Eucalyptus muelleriana*

Subcanopy Trees: 10-16m tall. Mean Projected Canopy Cover 60%

Cassine australis var. *australis, Cryptocarya microneura, Acmena smithii, Livistona australis, Pittosporum undulatum, Toona ciliata, Doryphora sassafras, Diospyros australis, Streblus brunonianus, Guioa semiglauca, Acacia maidenii, Dendrocnide excelsa, Diploglottis australis*

Tall Shrubs: 1-10m tall. Mean Projected Canopy Cover 40%

Ficus coronata, Claoxylon australe, Clerodendrum tomentosum, Croton verreauxii, Notelaea venosa, Pittosporum revolutum

Ground Covers: 0-1m tall. Mean Projected Canopy Cover 25%

Adiantum formosum, Gymnostachys anceps, Pittosporum multiflorum, Oplismenus imbecillis, Pseuderanthemum variabile, Carex longebrachiata, Pellaea falcata, Arthropteris tenella, Doodia aspera, Adiantum spp.

Vines & Climbers:

Marsdenia rostrata, Eustrephus latifolius, Morinda jasminoides, Cissus antarctica, Pandorea pandorana subsp. *pandorana, Smilax australis*

❑ *KEY IDENTIFYING FEATURES*

Easily recognisable features to assist in identifying this map unit are:

- A tall forest canopy dominated by White-topped box (*Eucalyptus quadrangulata*) in combination with:
- A dense mesic subcanopy tree-shrub layer comprising species such as Red olive plum (*Cassine australis* var. *australis*), Murrogun (*Cryptocarya microneura*), Cabbage tree palm (*Livistona australis*), Lilly pilly (*Acmena smithii*), Sweet pittosporum (*Pittosporum undulatum*), Sandpaper fig (*Ficus coronata*), Sassafras (*Doryphora sassafras*), Maiden's wattle (*Acacia maidenii*) and Giant stinging tree (*Dendrocnide excelsa*).
- A ferny understorey containing species such as Giant Maidenhair (*Adiantum formosum*), *Oplismenus imbecillis, Pseuderanthemum variabile,* and the rhizomatous fern *Arthropteris tenella.*
- A high abundance of vines and climbers and the presence of *Morinda jasminoides.*

❑ *EXAMPLE LOCATIONS*

Wongawilli; Huntley colliery; Mt. Kembla; Farmborough Heights; Upper Mullet Creek

❑ *CONSERVATION STATUS*

RESERVATION STATUS

Tenure	Study Area (ha)	Proportion of Total (%)	Sydney Basin Bioregion (ha/%)
National Park Estate	173.12	25.5	173 (6)
Water Catchment	0	0	7 (0.2)
State Forest	0	0	
Wollongong City Council Reserves	18.69	2.8	
Reserved Subtotal	191.81	28.2	
Other	487.51	71.8	
Total	679.32	100	>3000

CONDITION ASSESSMENT

Disturbance Class	Area (ha)	Proportion Extant (%)
A Light	206.99	30.5
B Moderate	338.89	49.9
C Heavy	108.53	16.0
Scattered trees	24.91	3.7
Total	679.32	100

❑ *THREATENED PLANT SPECIES*

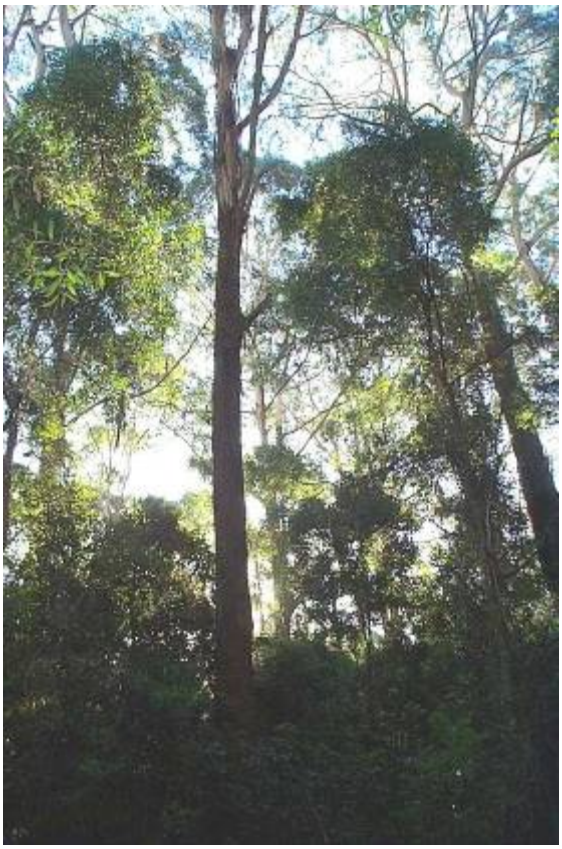
Cynanchum elegans (E1), *Daphnandra* sp. "Illawarra" (E1)

❑ *DIAGNOSTIC SPECIES*

Species Name	Group Score	Group Freq	Non Group Score	Non Group Freq	Fidelity Class
Acacia maidenii	4	0.56	1	0.38	positive
Acmena smithii	3	0.89	2	0.43	positive
Adiantum formosum	4	0.78	3	0.28	positive
Adiantum silvaticum	2	0.22	0	0.00	positive
Carex longebrachiata	2	0.56	2	0.20	positive
Cassine australis var. australis	3	1.00	3	0.36	positive
Claoxylon australe	2	0.56	2	0.19	positive
Croton verreauxii	2	0.56	3	0.24	positive
Cryptocarya microneura	4	1.00	2	0.26	positive
Dendrocnide excelsa	4	0.56	4	0.09	positive
Doodia aspera	3	0.56	3	0.45	positive
Doryphora sassafras	4	0.67	4	0.27	positive
Eucalyptus quadrangulata	4	0.89	4	0.19	positive
Ficus coronata	4	0.89	2	0.15	positive
Gymnostachys anceps	3	0.89	2	0.45	positive
Livistona australis	4	0.89	2	0.46	positive
Mallotus philippensis	2	0.11	0	0.00	positive
Morinda jasminoides	3	0.56	2	0.34	positive
Pellaea falcata	2	0.78	2	0.27	positive
Pittosporum multiflorum	2	0.78	2	0.35	positive
Toona ciliata	2	0.89	2	0.14	positive
Geitonoplesium cymosum	1	0.33	2	0.65	negative
Pandorea pandorana subsp. pandorana	2	0.44	2	0.65	negative
Eustrephus latifolius	2	0.89	2	0.65	constant
Marsdenia rostrata	2	1.00	2	0.54	constant
Notelaea venosa	3	0.56	3	0.57	constant
Oplismenus imbecillis	2	0.78	3	0.58	constant
Pittosporum undulatum	4	1.00	2	0.61	constant
Pseuderanthemum variabile	3	0.56	3	0.61	constant

MU10 Moist Gully Gum Forest

❑ *DESCRIPTION*



Moist Gully Gum Forest is a very tall (to 35 metres) forest occurring in the high rainfall zone on upper escarpment slopes and shale soils of the plateau south from Mount Brisbane. The canopy is variable although *Eucalyptus smithii* is most frequently recorded. On the escarpment, associated species include *Eucalyptus muelleriana* and *E. quadrangulata* and with less frequency *E. cypellocarpa, E. elata, E. pilularis* and *E. salignaXbotryoides*. On the plateau, *Eucalyptus cypellocarpa, E. elata* and *E. piperita* are more common. The rainforest subcanopy is less complex than other escarpment moist forests. Species include *Livistona australis*, *Cryptocarya* spp., *Acmena smithii* and *Eupomatia laurina*. The understorey supports a number of ferns and twiners common to moist forests of the escarpment including *Tylophora barbata*, *Smilax australis* and *Marsdenia rostrata*. *Acacia binervata* is often present within this community on the plateau and appears to signal areas of previous disturbance. Several sites supported a simplified structure with a distinctly grassy understorey dominated by *Lomandra longifolia*. Several of the mesic species are not present or are at lower abundance.

Moist Gully Gum Forest occurs above 300 metres in elevation on Narrabeen geologies of both the upper escarpment slopes and on protected slopes and gullies of the adjoining plateau. The community appears to extend south into Shellharbour and Kiama LGA's although the relationship with existing mapping is not precise. Mills (2000) refers to two similar communities for the Shellharbour LGA. Both White Box-Brown Barrel Forest and White Box-Yellow Stringybark Tall Forest share similarities with Moist Gully Gum Forest. Less clear is the relationship with broader regional communities defined by NPWS (2000a). Forest Ecosystem 18: Southern Costal Hinterland Moist-Shrub-Vine-Grass Forest shares overlap with some canopy and shrub species and is likely to be closely related to Moist Gully Gum Forest at the northern extent of its distribution. NPWS (2000a) considers it to be an extensively distributed and well reserved.

❑ *FLORISTIC SUMMARY*

Number of sites: 14

Trees: 15-55m tall. Mean Projected Canopy Cover 43%

Eucalyptus smithii, Eucalyptus muelleriana, Eucalyptus quadrangulata and less commonly *Eucalyptus piperita, Eucalyptus elata, Eucalyptus cypellocarpa*

Subcanopy Trees and shrubs: 2-20m tall. Mean Projected Canopy Cover 32%

Synoum glandulosum subsp. *glandulosum, Livistona australis, Acacia binervata, Acmena smithii, Cryptocarya glaucescens, Clerodendrum tomentosum, Notelaea venosa*

Ground Covers: 0-1m tall. Mean Projected Canopy Cover 37%

Lomandra longifolia, Hibbertia dentata, Oplismenus imbecillis, Pteridium esculentum, Microlaena stipoides var. *stipoides, Pseuderanthemum variabile, Goodenia ovata, Dianella caerulea*

Vines & Climbers:

Eustrephus latifolius, Smilax australis, Tylophora barbata, Pandorea pandorana subsp. *pandorana, Morinda jasminoides*

❑ *KEY IDENTIFYING FEATURES*

Easily recognisable features to assist in identifying this map unit are:

- A tall forest can opy and the presence of Gully gum (*Eucalyptus smithii*) and Yellow st ringybark (*E. muelleriana*).
- A mesic subcanopy tree-layer including Scentless rosewood (*Synoum glandulosum* subsp. *glandulosum*), Two-veined hickory (*Acacia binervata*), Lilly pilly (*Acmena smithii*), Jackwood (*Cryptocarya glaucescens*) and Smooth mock olive (*Notelaea venosa*).
- An understorey containing species such as Spiny-headed mat-rush (*Lomandra longifolia*), *Hibbertia dentata*, Bracken (*Pteridium esculentum*) and *Goodenia ovata.*

❑ *EXAMPLE LOCATIONS*

Mount Brisbane; Kembla Heights; Kembla State Forest; Bong Bong Pass; Macquarie Pass.

❑ *CONSERVATION STATUS*

RESERVATION STATUS

Tenure	Study Area (ha)	Proportion of Total (%)	Sydney Basin Bioregion (ha/%)
National Park Estate	424.53	39.5	1263 (46)
Water Catchment	210.01	19.6	1202 (44)
State Forest	49.05	4.6	49 (2)
Wollongong City Council Reserves	25.73	2.4	
Reserved Subtotal	709.32	66.0	
Other	364.85	34.0	
Total	1074.17	100	>2736

CONDITION ASSESSMENT

Disturbance Class	Area (ha)	Proportion Extant (%)
A Light	948.11	88.3
B Moderate	81.62	7.6
C Heavy	37.80	3.5
Scattered trees	6.64	0.6
Total	1074.17	100

❑ *THREATENED PLANT SPECIES*

None recorded

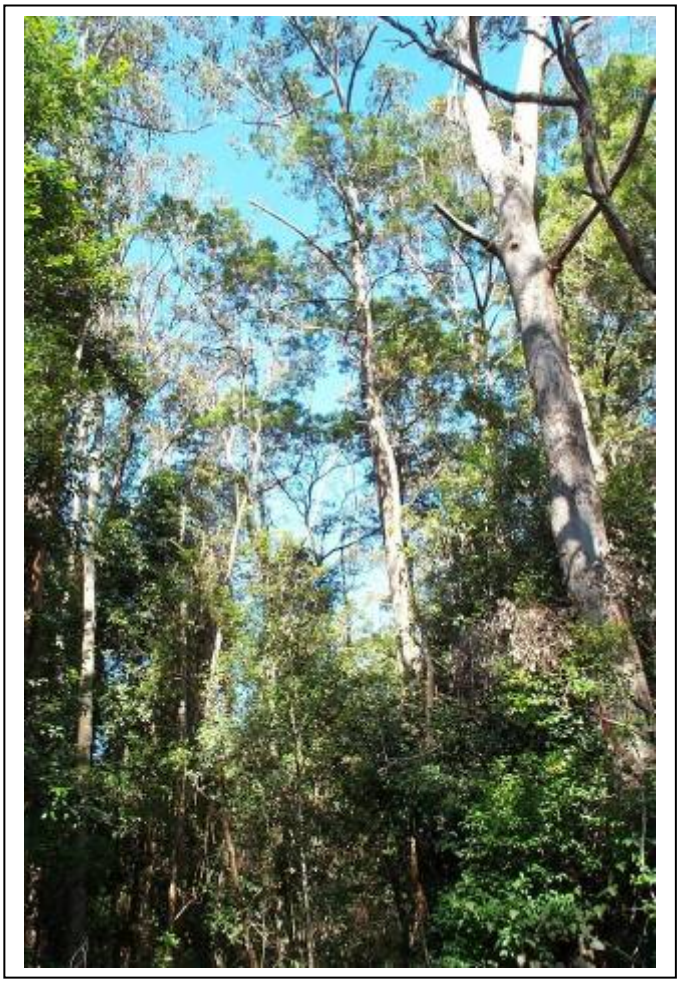
❑ *DIAGNOSTIC SPECIES*

Species Name	Group Score	Group Freq	Non Group Score	Non Group Freq	Fidelity Class
Acmena smithii	4	1.00	2	0.44	positive
Asplenium flabellifolium	2	0.63	2	0.36	positive
Beyeria lasiocarpa	1	0.13	0	0.00	positive
Cissus hypoglauca	3	0.75	2	0.17	positive
Clerodendrum tomentosum	2	1.00	1	0.40	positive
Cryptocarya glaucescens	4	0.88	4	0.25	positive
Cryptocarya microneura	4	0.50	3	0.29	positive
Doodia aspera	3	0.63	3	0.46	positive
Doryphora sassafras	4	0.63	4	0.28	positive
Eucalyptus muelleriana	5	0.50	5	0.03	positive

Species Name	Group Score	Group Freq	Non Group Score	Non Group Freq	Fidelity Class
Eucalyptus quadrangulata	4	0.75	4	0.21	positive
Eucalyptus smithii	4	0.88	4	0.02	positive
Eupomatia laurina	2	1.00	2	0.30	positive
Lastreopsis decomposita	3	0.88	3	0.18	positive
Livistona australis	2	1.00	3	0.46	positive
Morinda jasminoides	3	0.88	2	0.33	positive
Palmeria scandens	3	0.63	2	0.17	positive
Poa labillardieri var. labillardieri	2	0.50	3	0.27	positive
Sarcochilus olivaceus	1	0.13	0	0.00	positive
Smilax australis	2	0.88	2	0.44	positive
Synoum glandulosum subsp. glandulosum	4	0.88	2	0.38	positive
Tylophora barbata	2	0.88	2	0.32	positive
Geitonoplesium cymosum	1	0.75	2	0.63	negative
Eustrephus latifolius	2	0.75	2	0.66	constant
Marsdenia rostrata	2	0.88	2	0.54	constant
Pandorea pandorana subsp. pandorana	2	0.81	2	0.62	constant
Pseuderanthemum variabile	2	0.88	3	0.58	constant

MU11 Moist Blue Gum-Blackbutt Forest

❑ *DESCRIPTION*



Moist Blue Gum-Blackbutt Forest is a tall open forest with a predominantly warm temperate rainforest understorey. The most common canopy species are *Eucalyptus saligna*, *E. salignaXbotryoides, E. pilularis* and *Syncarpia glomulifera* subsp. *glomulifera*. Typical rainforest canopy includes *Doryphora sassafras, Cryptocarya glaucescens* and *Acmena smithii*. Shrubs include *Trochocarpa laurina, Pittosporum multiflorum, Breynia oblongifolia* and *Synoum glandulosum* subsp. *glandulosum*. Tree ferns (*Cyathea* spp. and *Dicksonia antarctica*) may also be present in this stratum. Ground cover can be variable depending on the degree of light penetration afforded by the rainforest layer. *Calochlaena dubia, Lomandra longifolia, Doodia aspera, Blechnum cartilagineum, Gymnostachys anceps* and *Oplismenus imbecillis* are common amongst vines and twiners such as *Tylophora barbata, Smilax australis, Pandorea pandorana* subsp. *pandorana* and *Stephania japonica* var. *discolor*. It occurs in the northern catchments of Cordeaux and Cataract on protected slopes underlain by Narrabeen shales and sandstones.

Moist Blue Gum-Blackbutt Forest supports a less diverse assemblage of mesic species to that found in similar forests on the escarpment. In particular, the mix of subtropical rainforest species in the understorey that marks the Escarpment Moist Blue Gum Forest are not present on the drier plateau. Variation in elevation and rainfall are likely to restrict the growth of species such as *Pennantia cunninghamii*, *Diospyros australis* and *Eupomatia laurina*. *Dendrocnide excelsa*, *Toona australis* and *Piper novae-hollandiae* are all more common below the escarpment.

❑ *FLORISTIC SUMMARY*

Number of sites: 12

Trees: 30-35 m tall. Mean Projected Canopy Cover 35%

Eucalyptus salignaXbotryoides, Eucalyptus smithii, Eucalyptus pilularis, Eucalyptus cypellocarpa, Eucalyptus elata, Eucalyptus muelleriana, Eucalyptus sieberi, Syncarpia glomulifera subsp. *glomulifera*

Subcanopy Trees and shrubs: 15-20 m tall. Mean Projected Canopy Cover50%

Acmena smithii, Cryptocarya glaucescens, Doryphora sassafras, Diploglottis australis, Ceratopetalum apetalum, Synoum glandulosum subsp. *glandulosum, Trochocarpa laurina, Livistona australis*

Ground Covers: 0-1 m tall. Mean Projected Canopy Cover 25%

Lomandra longifolia, Pteridium esculentum, Blechnum cartilagineum, Calochlaena dubia

Vines & Climbers:

Eustrephus latifolius, Smilax australis, Tylophora barbata, Pandorea pandorana subsp. *pandorana, Morinda jasminoides*

❑ *KEY IDENTIFYING FEATURES*

Easily recognisable features to assist in identifying this map unit are:

- Tall moist sclerophyll forest on sheltered aspects within the plateau water catchments of Avon, Cordeaux and Cataract.
- Tall Blue gums (*Eucalyptus saligna, E. salignaXbotryoides, E. botryoides*) in combination with Gully gum (*E. smithii*), Mountain grey gum (*E. cypellocarpa*) and River peppermint (*E. elata*).
- A tall subcanopy of ra inforest species dominated by Lilly pilly (*Acmena smithii*), Coachwood (*Ceratopetalum apetalum*), Bolwarra (*Eupomatia laurina*) and Sassafras (*Doryphora sassafras*).

❑ *EXAMPLE LOCATIONS*

Bellambi Creek, Flying Fox Creek

❑ *CONSERVATION STATUS*

RESERVATION STATUS

Tenure	Study Area (ha)	Proportion of Total (%)	Sydney Basin Bioregion (ha/%)
National Park Estate	4.21	1.5	47 (4)
Water Catchment	60.25	21.5	835 (70)
State Forest	0	0	
Wollongong City Council Reserves	0	0	
Reserved Subtotal	64.46	33.0	
Other	216.26	77.0	
Total	280.72	100	>1200

CONDITION ASSESSMENT

Disturbance Class	Area (ha)	Proportion Extant (%)
A Light	174.42	62.2
B Moderate	82.56	29.4
C Heavy	12.92	4.6
Scattered trees	10.52	3.7
Total	280.72	100

❑ *THREATENED PLANT SPECIES*

None recorded

❑ *DIAGNOSTIC SPECIES*

(Note that Abundance Scores are derived from a 1-6 Braun Blanquet Cover Scale: Diagnostic species have been drawn from sites located on the plateau water catchments only. Some species considered diagnostic for the catchment areas may be common below the escarpment)

Species Name	Group Score	Group Freq	Non Group Score	Non Group Freq	Fidelity Class
Acmena smithii	2	0.58	2	0.05	positive
Acronychia oblongifolia	2	0.08	0	0.00	positive
Aneilema acuminatum	1	0.08	0	0.00	positive
Blechnum camfieldii	2	0.08	0	0.00	positive
Canthium coprosmoides	2	0.08	0	0.00	positive
Cassine australis var. australis	4	0.08	0	0.00	positive
Commersonia fraseri	2	0.25	0	0.00	positive
Cryptocarya glaucescens	3	0.67	2	0.03	positive

Species Name	Group Score	Group Freq	Non Group Score	Non Group Freq	Fidelity Class
Cyathea australis	2	0.50	2	0.04	positive
Deeringia amaranthoides	1	0.08	0	0.00	positive
Doryphora sassafras	3	0.58	3	0.04	positive
Euroschinus falcata var. falcata	1	0.08	0	0.00	positive
Geijera salicifolia var. latifolia	2	0.08	0	0.00	positive
Hibbertia dentata	2	0.50	2	0.06	positive
Hibbertia scandens	2	0.50	2	0.07	positive
Kennedia prostrata	2	0.08	0	0.00	positive
Livistona australis	2	1.00	1	0.06	positive
Lomandra longifolia	2	0.67	2	0.44	positive
Marsdenia flavescens	1	0.08	0	0.00	positive
Notelaea longifolia forma longifolia	2	0.58	1	0.04	positive
Pteridium esculentum	2	0.50	2	0.40	positive
Rhodamnia rubescens	2	0.08	0	0.00	positive
Smilax australis	2	1.00	2	0.06	positive
Stephania japonica var. discolor	2	0.50	2	0.02	positive
Synoum glandulosum	2	0.67	2	0.04	positive
Trochocarpa laurina	2	0.67	2	0.02	positive
Tylophora barbata	2	0.50	2	0.08	positive
Wilkiea huegeliana	2	0.08	0	0.00	positive
Corymbia gummifera	0	0.00	2	0.56	negative

MU12 Moist Brown Barrel Forest

❑ *DESCRIPTION*

Moist Brown Barrel Forest is a tall forest rising over 40 metres in height on the Talus benches within Macquarie Pass National Park. *Eucalyptus fastigata, E. smithii, E. muelleriana* and *Syncarpia glomulifera* subsp. *glomulifera* form a mixed canopy above a tall rainforest subcanopy. The height and composition of the subcanopy varies depending on past logging and clearing activities. In less disturbed areas, a dense rainforest subcanopy up to twenty metres in height supports *Cryptocarya* spp., *Ceratopetalum apetalum, Livistona australis* and *Acmena smithii*. The ground cover is generally very sparse with only a few scattered ferns present amongst deep litter cover. Some areas are highly disturbed with even aged regrowth Eucalypt stands present above a sparse mesic shrub layer. *Acacia melanoxylon* and regenerating *Syncarpia glomulifera* subsp. *glomulifera* feature prominently.

Moist Brown Barrel Forest appears to extend southwards beyond the Study Area into Shellharbour LGA. Mills (2000) identifies a community labelled as White Box-Brown Barrel Tall Forest occupying similar habitat and NPWS (2000a) considers that the moist forests dominated by *Eucalyptus fastigata* in this area form a component of Forest Ecosystem 57 (Southern Escarpment Shrub Fern Moist Forest). However, this Ecosystem appears drier and shrubbier than the Moist Brown Barrel Community of the escarpment. NPWS (2000a) may be inaccurate given the absence of site data in the Illawarra.

❑ *FLORISTIC SUMMARY*

Number of Sites: 3

Trees: 25-50m tall. Mean Projected Canopy Cover 40%

Eucalyptus fastigata, Eucalyptus smithii, Eucalyptus muelleriana, Syncarpia glomulifera subsp. *glomulifera*

Subcanopy Trees & Shrubs: 6-18m tall. Mean Projected Canopy Cover 48%

Syncarpia glomulifera subsp. *glomulifera, Cryptocarya glaucescens, Acmena smithii, Livistona australis*

Ground Covers: 0-2m tall. Mean Projected Canopy Cover 40%

Lastreopsis decomposita, Lepidosperma laterale, Lomandra longifolia, Clematis glycinoides

Vines and Twiners

Tylophora barbata, Morinda jasminoides, Marsdenia rostrata, Smilax australis

❑ *KEY IDENTIFYING FEATURES*

Easily recognisable features to assist in identifying this map unit are:

- Tall to very tall open forest dominated by Brown barrel (*Eucalyptus fastigata*) and Gully gum (*E. smithii*).
- A tall dense rainforest subcanopy dominated by Laurels (*Cryptocarya spp.*).
- A very sparse to open ground layer with high abundance of leaf litter.
- Located on escarpment slopes above 250 metres in elevation south from Macquarie Pass National Park.

❑ *EXAMPLE LOCATIONS*

Macquarie Pass National Park

❑ *CONSERVATION STATUS*

RESERVATION STATUS

Tenure	Study Area (ha)	Proportion of Total (%)	Sydney Basin Bioregion (ha/%)
National Park Estate	97.27	98.6	>100 (3)
Water Catchment	0	0	
State Forest	0	0	
Wollongong City Council Reserves	0	0	
Reserved Subtotal	97.27	98.6	
Other	1.43	1.4	
Total	98.70	100	>3000

CONDITION ASSESSMENT

Disturbance Class	Area (ha)	Proportion Extant (%)
A Light	98.70	100
B Moderate	0	0
C Heavy	0	0
Scattered trees	0	0
Total	98.70	100

❑ *THREATENED PLANT SPECIES*

None recorded

❑ *DIAGNOSTIC SPECIES*

Species Name	Group Score	Group Freq	Non Group Score	Non Group Freq	Fidelity Class
Centella asiatica	2	0.67	2	0.11	positive
Cinnamomum oliveri	2	0.33	0	0.00	positive
Cryptocarya glaucescens	4	0.67	4	0.27	positive
Eucalyptus fastigata	5	0.67	0	0.00	positive
Eucalyptus smithii	5	0.67	4	0.05	positive
Hibbertia dentata	2	1.00	2	0.14	positive
Lepidosperma laterale	3	0.67	2	0.13	positive
Lepidosperma urophorum	1	0.33	0	0.00	positive
Livistona australis	2	0.67	2	0.48	positive
Lomandra longifolia	4	0.67	2	0.45	positive
Melichrus urceolatus	1	0.33	0	0.00	positive
Microlaena stipoides var. stipoides	2	0.67	3	0.23	positive
Morinda jasminoides	2	0.67	2	0.35	positive
Nematolepis squamea subsp. squamea	5	0.33	0	0.00	positive
Persoonia linearis	3	0.67	1	0.04	positive
Pomaderris ferruginea	1	0.33	0	0.00	positive
Syncarpia glomulifera subsp. glomulifera	5	1.00	4	0.18	positive
Tylophora barbata	2	1.00	2	0.34	positive
Geitonoplesium cymosum	1	0.67	2	0.64	negative
Notelaea venosa	2	0.33	3	0.58	negative
Oplismenus imbecillis	0	0.00	3	0.60	negative
Pandorea pandorana subsp. pandorana	1	0.33	2	0.65	negative
Pittosporum undulatum	0	0.00	2	0.64	negative

MU13 Moist Box-Red Gum Foothills Forest

❑ *DESCRIPTION*

Moist Box-Red Gum Foothills Forest is dominated by *Eucalyptus quadrangulata* with *E. tereticornis* and/or *E. salignaXbotryoides* as infrequent associate species. A low mesic shrub layer is always present. Typical shrub and small tree species are closely affiliated to the Lowland Dry-Subtropical Rainforest assemblages that occur as part of the complex of vegetation on the escarpment foothills. Hardy and/or pioneer rainforest species such *as Croton verreauxii, Cassine australis* var. *australis, Backhousia myrtifolia, Streblus* brunonianus and *Pittosporum* spp. frequently occur. Ground cover is usually a sparse cover of ferns such as *Doodia aspera* and *Pellaea falcata*.

Moist Red Gum-Box Foothills Forest marks a transition between the Grassy Red Gum forests on exposed slopes and ridges to the Lowland Dry-Subtropical Rainforest complex on richer latite soils, sheltered aspects and rocky scree slopes. It shares the same geologies, that of Gerringong volcanics and Permian shales and siltstones and a similar elevational range of between 30 and 200 metres. It extends from footslopes south of Mt. Keira into Shellharbour LGA. Mills (2000) alludes to a similar community described as Red Gum-Rainforest and another as Red Gum-Blue Gum Forest. NPWS (2000a) does not describe a similar community within the South Coast Region.

A variation within this community is a low forest dominated by *Melaleuca styphelioides* occurring in gully lines within Blackbutt Reserve, the foothills of the Calderwood Valley and on the crest of Mt. Nebo. A number of survey sites that aligned with this community appeared to be depauperate or disturbed assemblages of either the Moist Coastal White Box Forest and Escarpment Moist Blue Gum Forest. Examples include the Blue Gum forests on open slopes underneath Mt. Keira, where *Backhousia myrtifolia* is prolific.

❑ *FLORISTIC SUMMARY*

Number of Sites: ***19***

Trees: 18-35m tall. Mean Projected Canopy Cover 35%

Eucalyptus tereticornis, Eucalyptus quadrangulata, Eucalyptus salignaXbotryoides, Melaleuca styphelioides

Subcanopy Trees and shrubs: 1-15m tall. Mean Projected Canopy Cover 60%

Croton verreauxii, Cassine australis var. *australis, Backhousia myrtifolia, Streblus brunonianus, Pittosporum undulatum, Pittosporum revolutum, Acmena smithii, Notelaea venosa, Alphitonia excelsa, Rapanea variabilis*

Ground Covers: 0-1m tall. Mean Projected Canopy Cover 30%

Doodia aspera, Pyrrosia rupestris, Pellaea falcata, Gymnostachys anceps

Vines & Climbers:

Morinda jasminoides, Smilax australis, Parsonsia straminea

❑ *KEY IDENTIFYING FEATURES*

Easily recognisable features to assist in identifying this map unit are:

- A canopy dominated by Forest red gum (*Eucalyptus tereticornis),* White box (*E. quadrangulata*) and sometimes Blue gum (*E. salignaXbotryoides*).
- A variable mesic shrub understorey including Grey Myrtle (*Backhousia myrtifolia*) as a key species in combination with Red olive plum (*Cassine australis* var. *australis*), Native cascarilla (*Croton verreauxii*) and low densities of Whalebone tree (*Streblus brunonianus*).
- Escarpment Foothills on Permian siltstones and shales and Gerringong Volcanics.

❑ *EXAMPLE LOCATIONS*

Avondale hills; Wongawilli Mine; Blackbutt Reserve

❑ *CONSERVATION STATUS*

RESERVATION STATUS

Tenure	Study Area (ha)	Proportion of Total (%)	Sydney Basin Bioregion (ha/%)
National Park Estate	22.64	3.7	23 (2)
Water Catchment	0	0	
State Forest	0	0	
Wollongong City Council Reserves	30.41	4.9	
Reserved Subtotal	53.05	8.6	
Other	567.03	91.5	
Total	620.08	100	1022

CONDITION ASSESSMENT

Disturbance Class	Area (ha)	Proportion Extant (%)
A Light	46.69	7.5
B Moderate	216.12	34.9
C Heavy	313.34	50.5
Scattered trees	43.93	7.1
Total	620.08	100

❑ *THREATENED PLANT SPECIES*

Cynanchum elegans (E1); *Daphnandra* sp. "Illawarra" (E1); *Irenepharsus trypherus* (E1)

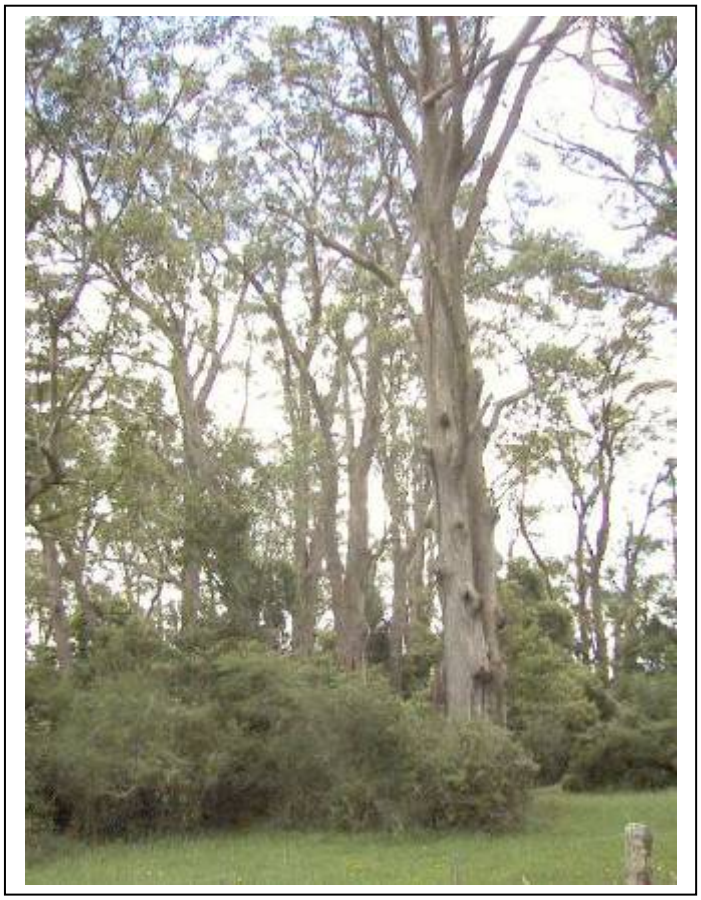
❑ *DIAGNOSTIC SPECIES*

Species Name	Group Score	Group Freq	Non Group Score	Non Group Freq	Fidelity Class
Acmena smithii	2	0.52	2	0.46	positive
Asplenium flabellifolium	3	0.81	2	0.31	positive
Backhousia myrtifolia	5	0.62	4	0.08	positive
Cassine australis var. australis	4	0.95	2	0.32	positive
Clerodendrum tomentosum	2	0.76	1	0.38	positive
Croton verreauxii	4	0.90	3	0.18	positive

Species Name	Group Score	Group Freq	Non Group Score	Non Group Freq	Fidelity Class
Doodia aspera	3	0.81	3	0.42	positive
Doodia australis	1	0.05	0	0.00	positive
Eucalyptus quadrangulata	4	0.52	4	0.19	positive
Gymnostachys anceps	2	0.76	2	0.44	positive
Morinda jasminoides	2	0.52	2	0.33	positive
Nyssanthes diffusa	2	0.05	0	0.00	positive
Panicum pygmaeum	3	0.10	0	0.00	positive
Parsonsia straminea	2	0.67	1	0.32	positive
Pellaea falcata	2	0.86	2	0.23	positive
Pittosporum multiflorum	3	0.86	2	0.31	positive
Pittosporum revolutum	2	0.52	1	0.37	positive
Pyrrosia rupestris	2	0.52	2	0.21	positive
Rapanea variabilis	2	0.71	2	0.34	positive
Smilax australis	2	0.57	2	0.45	positive
Wilkiea huegeliana	2	0.57	2	0.14	positive
Streblus brunonianus	2	0.67	2	0.21	positive
Geitonoplesium cymosum	1	1.00	2	0.59	negative
Eustrephus latifolius	2	0.91	2	0.63	constant
Marsdenia rostrata	2	0.68	2	0.55	constant
Notelaea venosa	4	1.00	2	0.51	constant
Oplismenus imbecillis	3	0.77	3	0.56	constant
Pandorea pandorana subsp. pandorana	2	0.86	2	0.61	constant
Pittosporum undulatum	2	0.64	2	0.63	constant
Pseuderanthemum variabile	3	0.91	3	0.57	constant

MU14 Robertson Basalt Brown Barrel Forest

❑ *DESCRIPTION*



Robertson Basalt Brown Barrel Forest was once a very tall and majestic forest dominated by *Eucalyptus fastigata* with a tall moist understorey. Heavily degraded remnants of this community are what persist today, with understorey likely to reflect only a portion of species that may have once occurred. The rapid recolonising species *Acacia melanoxylon* features in several stratum. At times it forms a tall small tree above a moist shrub layer that can include *Coprosma quadrifida*, *Alectryon subcinereus*, *Dicksonia antarctica*, *Rubus parvifolius* and *Senecio linearifolius*. Vines typical of moist environments are common, and include *Eustrephus latifolius*, *Tylophora barbata and Smilax australis*. The density of ground cover is highly variable depending on disturbance to canopy and shrub layers. Where underscrubbing has occurred, *Lomandra longifolia and Poa labillardierei* var. *labillardierei* are abundant. Greater soil moisture retention affords suitable habitat for herbs *Dichondra repens*, *Viola hederacea* and ferns *Pyrrosia rupestris* and *Asplenium flabellifolium*.

The rich basalt soils of the Robertson Plateau between Kangaloon and the Escarpment edge are likely to have comprised the original distribution within the catchments. It is likely that this community would have formed a grade with Robertson Cool-Warm Temperate Rainforests in sheltered slopes and gullies.

This community forms a component of Robertson Basalt Tall Open-forest, an Endangered Ecological Community listed on Part 3 of Schedule 1 of the Threatened Species Conservation Act, 1995.

❑ *FLORISTIC SUMMARY*

Number of Sites: 7

Trees: 25-35m tall. Mean Projected Canopy Cover 35%

Eucalyptus fastigata, Eucalyptus cypellocarpa, Eucalyptus quadrangulata, Eucalyptus smithii

Small Trees and Shrubs: 2-5m tall. Mean Projected Shrub Cover 25%

Acacia melanoxylon, Coprosma quadrifida, Cyathea australis, Alphitonia excelsa, Hedycarya angustifolia, Pittosporum undulatum, Synoum glandulosum subsp. *glandulosum, Notelaea venosa*

Ground covers: 0-1 m tall. Mean Projected Ground Cover 15%

Microlaena stipoides var. *stipiodes, Dichondra repens, Lomandra longifolia, Hydrocotyle peduncularis, Hibbertia scandens, Viola hederacea*

Vines and Twiners

Tylophora barbata, Eustrephus latifolius, Clematis aristata, Smilax australis

❑ *KEY IDENTIFYING FEATURES*

Easily recognisable features to assist in identifying this map unit are:

- Very tall Brown barrel (*Eucalyptus fastigata*) on red basalt soils of the Roberston Plateau.
- A tall small tree layer of Blackwood (*Acacia melanoxylon*).
- A moist shrub understorey that includes tree ferns (*Dicksonia antarctica* and *Cyathea australis*), Red ash (*Alphitonia excelsa*) and Prickly currant bush (*Coprosma quadrifida*).

❑ *EXAMPLE LOCATIONS*

Private Land in Robertson and Kangaloon area, Macquarie Hill

❑ *CONSERVATION STATUS*

Listed as an Endangered Ecological Community under Part 3 of Schedule 1 of the Threatened Species Conservation Act (1995) as part of Robertson Basalt Tall Open-forest.

RESERVATION STATUS

Tenure	Study Area (ha)	Proportion of Total (%)	Sydney Basin Bioregion (ha/%)
National Park Estate	1.66	44.3	2 (0.2)
Water Catchment	0.72	19.2	506 (54)
State Forest	0	0	
Wollongong City Council Reserves	0	0	
Reserved Subtotal	2.38	63.5	
Other	1.37	36.5	
Total	3.75	100	935

CONDITION ASSESSMENT

Disturbance Class	Area (ha)	Proportion Extant (%)
A Light	3.75	100
B Moderate	0	0
C Heavy	0	0
Scattered Trees	0	0
Total	3.75	100

❑ *THREATENED PLANT SPECIES*

None recorded

❑ *DIAGNOSTIC SPECIES*

Species Name	Group Score	Group Freq	Non Group Score	Non Group Freq	Fidelity Class
Ajuga australis	1	0.33	0	0.00	positive
Asperula spp.	2	0.33	0	0.00	positive
Austrocynoglossum latifolium	2	0.67	0	0.00	positive
Carex breviculmis	1	0.33	0	0.00	positive
Clematis aristata	2	0.67	1	0.10	positive
Daucus glochidiatus	1	0.33	0	0.00	positive
Desmodium varians	2	0.67	2	0.05	positive
Eucalyptus fastigata	4	0.67	4	0.01	positive
Galium gaudichaudii	2	0.33	0	0.00	positive
Geitonoplesium cymosum	2	0.67	1	0.05	positive
Geranium homeanum	2	0.67	1	0.02	positive

Species Name	Group Score	Group Freq	Non Group Score	Non Group Freq	Fidelity Class
Glycine clandestina	2	0.67	1	0.13	positive
Hydrocotyle acutiloba	2	0.67	2	0.01	positive
Luzula flaccida	1	0.33	0	0.00	positive
Notelaea ovata	1	0.33	0	0.00	positive
Plectranthus parviflorus	2	0.67	1	0.01	positive
Poa affinis	4	0.67	2	0.01	positive
Poa labillardierei var. labillardierei	4	1.00	2	0.04	positive
Scutellaria humilis	2	0.33	0	0.00	positive
Smilax australis	2	0.67	1	0.09	positive
Stellaria flaccida	4	1.00	2	0.02	positive
Tylophora barbata	2	1.00	2	0.10	positive
Corymbia gummifera	0	0.00	2	0.52	negative
Entolasia stricta	0	0.00	2	0.54	negative
Acacia melanoxylon	1	0.67	2	0.04	uninformative

MU15 Moist Shale Messmate Forest

❑ *DESCRIPTION*

Moist Shale Messmate Forest occurs on soils derived from Wianamatta Shale at elevations above 600 metres. The tall forest canopy comprises combinations of *Eucalyptus obliqua, E. cypellocarpa, E. piperita* and *E. globoidea*. *Eucalyptus obliqua* is not always present, although it is uniqu e to this commu nity within Wollongong LGA. The shrub and small tree layer is typically open to sp arse with *Acacia binervata* and *Leucopogon lanceolatus* var. *lanceolatus* most common. The tree fern *Cyathea australis*, may also b e present. T he ground cover is a dense mat of herbs such as *Gonocarpus teucrioides, Stellaria flaccida, Desmodium varians* and *Pratia purpurascens* with grasses including *Poa labillardieri* var. *labillardieri* and the rush *Lomandra longifolia.*

In the Woll ongong LGA this com munity is restricted to a small area at Macquarie Hill. It is more extensively distributed at the so uthern end of the Avon Catchment near Robertson. Moist Shale Messmate Forest closely resem bles Ecosystem 57 Southern Escarpment Fern/Herb/Moist Forest (NPWS, 2000a) in habitat, forest structure and floristic composition. Over half of the extant area of this Ecosyste m is located within reserves.

❑ *FLORISTIC SUMMARY*

Number of Sites: 1

Trees: 20-25m tall. Mean Projected Canopy Cover 45%

Eucalyptus obliqua, Eucalyptus piperita, Eucalyptus cypellocarpa, Eucalyptus globoidea

Subcanopy Trees and shrubs: 1-8m tall. Mean Projected Canopy Cover 5%

Acacia binervata, Leucopogon lanceolatus var*. lanceolatus*

Ground Covers: 0-1m tall. Mean Projected Canopy Cover 95%

Pteridium esculentum, Pratia purpurascens, Lomandra longifolia, Dianella caerulea, Viola hederacea, Gonocarpus teucrioides, Poranthera microphylla, Entolasia marginata, Hibbertia scandens, Dichondra repens, Lagenifera stipitata, Blechnum cartilagineum

Vines & Climbers:

Glycine clandestina, Tylophora barbata, Clematis aristata

❑ *KEY IDENTIFYING FEATURES*

Easily recognisable features to assist in identifying this map unit are:

- Location at higher altitudes and on better soils of the plateau.
- A tall forest canopy comprising any of the followi ng Mountain grey gu m (*Eucalyptus cypellocarpa*), Narrow leaved stringybark (*E. globoidea*), Messmate stringybark (*E. obliqua*) and Sydney peppermint (*E. piperita*).
- The presence of La nce-leaf beard-heath (*Leucopogon lanceolatus* var. *lanceolatus*) and Two veined hickory (*Acacia binervata*).

- A diverse herbaceous understorey containing species such as Bracken (*Pteridium esculentum*), White root (*Pratia purpurascens*), Spiny-headed mat-rush (*Lomandra longifolia*), Paroo lily (*Dianella caerulea*), Native violet (*Viola hederacea*), Raspwort (*Gonocarpus teucrioides*), Small pora nthera (*Poranthera microphylla*), Bordered panic (*Entolasia marginata*), Climbing guinea flower (*Hibbertia scandens*), Kidney weed (*Dichondra repens*) and *Lagenifera stipitata.*

❑ *EXAMPLE LOCATIONS*

Macquarie Hill

❑ *CONSERVATION STATUS*

This community forms part of the Southern Highlands Shale Woodlands listed as an Endangered Ecological Community under Part 3 of Schedule 1 of the Threatened Species Conservation Act (1995).

RESERVATION STATUS

Tenure	Study Area (ha)	Proportion of Total (%)	Sydney Basin Bioregion (ha/%)
National Park Estate	13.98	15.9	965 (11)
Water Catchment	22.42	25.4	727 (8)
State Forest	0	0	
Wollongong City Council Reserves	0	0	
Reserved Subtotal	36.40	41.3	
Other	51.78	58.7	
Total	88.18	100	7024

CONDITION ASSESSMENT

Disturbance Class	Area (ha)	Proportion Extant (%)
A Light	41.48	47.0
B Moderate	30.44	34.5
C Heavy	14.46	16.4
Scattered trees	1.80	2.0
Total	88.18	100

❑ *THREATENED PLANT SPECIES*

None recorded

❑ *DIAGNOSTIC SPECIES*

(Note that Abundance Scores are derived from a 1-6 Braun Blanquet Cover Scale: Diagnostic species have been drawn from sites located on the plateau water catchments only. Some species considered diagnostic for the catchment areas may be common below the escarpment)

Species Name	Group Score	Group Freq	Non Group Score	Non Group Freq	Fidelity Class
Acacia binervata	2	0.50	2	0.12	positive
Adiantum aethiopicum	2	0.50	2	0.03	positive
Adiantum formosum	2	0.25	0	0.00	positive
Asperula conferta	2	0.25	0	0.00	positive
Blechnum cartilagineum	2	0.75	2	0.12	positive
Calochlaena dubia	3	1.00	3	0.12	positive
Carex longebrachiata	2	0.50	2	0.02	positive
Ceratopetalum apetalum	3	0.50	3	0.06	positive
Commelina cyanea	2	0.25	0	0.00	positive
Cyathea australis	3	0.75	2	0.05	positive
Dianella caerulea	2	0.75	2	0.31	positive

Species Name	Group Score	Group Freq	Non Group Score	Non Group Freq	Fidelity Class
Eucalyptus cypellocarpa	4	0.50	2	0.03	positive
Eucalyptus piperita	2	0.50	3	0.38	positive
Eustrephus latifolius	2	0.50	2	0.09	positive
Gahnia sieberiana	2	0.50	2	0.10	positive
Galium propinquum	2	0.50	2	0.04	positive
Goodenia ovata	2	0.50	2	0.01	positive
Hydrocotyle laxiflora	2	0.50	2	0.05	positive
Lepidosperma laterale	2	0.50	2	0.27	positive
Leucopogon lanceolatus var. lanceolatus	2	0.75	2	0.21	positive
Lomandra longifolia	3	0.75	2	0.44	positive
Melaleuca linariifolia	3	0.50	2	0.02	positive
Pratia purpurascens	2	0.50	2	0.11	positive
Pteridium esculentum	2	1.00	2	0.39	positive
Pultenaea flexilis	3	0.50	2	0.03	positive
Sigesbeckia orientalis subsp. orientalis	1	0.25	0	0.00	positive
Stellaria flaccida	3	0.50	2	0.01	positive
Sticherus flabellatus	3	0.50	2	0.04	positive
Tylophora barbata	2	0.50	2	0.09	positive
Viola hederacea	2	1.00	2	0.12	positive
Viola hederacea	2	1.00	2	0.12	positive
Corymbia gummifera	0	0.00	2	0.55	negative

MU16 Escarpment Blackbutt Forest

❑ *DESCRIPTION*

Escarpment Blackbutt Forest occurs on steep escarpment slopes, spurs and foothills of the northern escarpment. It is a tall to very tall forest supporting a canopy dominated by *Eucalyptus pilularis, E. botryoides* and *Syncarpia glomulifera* subsp. *glomulifera*. *Eucalyptus paniculata* subsp. *paniculata* is an irregular member of the canopy although it becomes more frequent in the north of the LGA in Royal National Park. A small tree layer of *Allocasuarina torulosa, Acacia maidenii, Pittosporum undulatum* and *Synoum glandulosum* subsp. *glandulosum* is consistently found within this community. Ground covers can vary from a dense fern (usually *Calochlaena dubia*) or herb cover (*Dichondra repens, Pseuderanthemum variabile*) on protected sites to one of dense grass and rush cover *(Lomandra longifolia, Poa labillardieri* var. *labillardieri*). Variations within this Map Unit are apparent at Coniston in remnant vegetation on Permian shales. Remnant *Eucalyptus pilularis* trees are a feature of the coastal plains and hills on Permian siltstone and shales around Mangerton and Wollongong. These variations may have once been more extensive.

Escarpment Blackbutt Forest appears to extend north into the Royal National Park along the deeper gullies of the Hacking River. Less clear is the relationship between Blackbutt communities above and below the escarpment. Comparative site data suggests that lower rainfall, greater sand content in the soil and higher elevations produce a grassier and shrubbier community on the plateau with species such as *E. piperita* frequently occurring as canopy co-dominants. No easily comparable ecosystem is found in the South Coast Region (NPWS, 2000a). However, Mills (2000) describes a community known as Blackbutt Tall Forest in Shellharbour LGA that is likely to share similar species. In the Watagan Ranges north of Sydney, a community dominated by *E. pilularis* is known to occur. This vegetation community described by NPWS (2000b) as Coastal Ranges Open Forest shares a very similar forest structure and a number of diagnostic species. However, the proximity of the Illawarra escarpment to the coast supports a number of defining species that are not present within this northern community. The most obvious of these is *Eucalyptus botryoides.*

❑ *FLORISTIC SUMMARY*

Number of Sites:21

Trees: 20-35m tall. Mean Projected Canopy Cover 43%

Eucalyptus pilularis, Syncarpia glomulifera subsp*. glomulifera, Eucalyptus botryoides, Eucalyptus paniculata* subsp*. paniculata*

Subcanopy Trees and shrubs: 10-20m tall. Mean Projected Canopy Cover 30%

Synoum glandulosum subsp. *glandulosum, Acacia maidenii, Livistona australis, Allocasuarina torulosa Pittosporum undulatum, Rapanea variabilis*

Shrubs: 1-8m tall. Mean Projected Canopy Cover 26%

Pittosporum revolutum, Breynia oblongifolia, Notelaea venosa, Clerodendrum tomentosum, Eupomatia laurina, Trochocarpa laurina

Ground Covers: 0-1m tall. Mean Projected Canopy Cover 56%

Pseuderanthemum variabile, Oplismenus imbecillis, Lomandra longifolia, Doodia aspera, Entolasia marginata, Dianella caerulea, Dichondra repens, Calochlaena dubia, Hibbertia dentata, Poa labillardieri var. *labillardieri, Imperata cylindrica* var. *major, Hibbertia scandens*

Vines & Climbers:

Tylophora barbata, Eustrephus latifolius, Geitonoplesium cymosum, Stephania japonica var*. discolor, Glycine clandestina, Pandorea pandorana* subsp*. pandorana, Marsdenia rostrata, Rubus parviflorus, Clematis glycinoides, Smilax australis*

❑ *KEY IDENTIFYING FEATURES*

Easily recognisable features to assist in identifying this map unit are:

- A tall forest canopy comprising Blackbutt (*Eucalyptus pilularis*), Turpentine (*Syncarpia glomulifera* subsp. *glomulifera*) and occasionally Grey ironbark (*E. paniculata* subsp. *paniculata*).
- The presence of Bastard rosewood (*Synoum glandulosum* subsp. *glandulosum*), Forest oak (*Allocasuarina torulosa*) Sweet pittosporum (*Pittosporum undulatum*)
- An understorey containing species such as *Pseuderanthemum variabile*, *Oplismenus imbecilis*, Spiny-headed mat-rush (*Lomandra longifolia*), Common ground fern (*Calochlaena dubia*) and Tussock (*Poa labillardieri* var. *labillardieri*).
- An abundance of vines and climbers and in particular the presence of Bearded tylophora (*Tylophora barbata*).

❑ *EXAMPLE LOCATIONS*

Stanwell Tops, Stanwell Park; Buttenshaw Drive, Coledale; Foothills at Austinmer, Thirroul and Woonona; Bulli Pass; West Corrimal; Tarawanna; Mangerton; Blackbutt Reserve.

❑ *CONSERVATION STATUS*

RESERVATION STATUS

Tenure	Study Area (ha)	Proportion of Total (%)	Sydney Basin Bioregion (ha/%)
National Park Estate	135.11	7.4	9207 (62)
Water Catchment	0.41	0.0	0.4 (0)
State Forest	0	0	
Wollongong City Council Reserves	153.33	8.4	
Reserved Subtotal	288.85	15.8	
Other	1544.66	84.2	
Total	1833.51	100	14811

CONDITION ASSESSMENT

Disturbance Class	Area (ha)	Proportion Extant (%)
A Light	742.32	40.5
B Moderate	428.78	23.4
C Heavy	314.65	17.2
Scattered trees	347.76	19.0
Total	1833.51	100

❑ *THREATENED PLANT SPECIES*

None recorded

❑ *DIAGNOSTIC SPECIES*

Species Name	Group Score	Group Freq	Non Group Score	Non Group Freq	Fidelity Class
Acacia maidenii	2	0.79	1	0.36	positive
Allocasuarina torulosa	4	0.64	1	0.02	positive
Breynia oblongifolia	2	0.64	1	0.36	positive
Calochlaena dubia	4	0.64	3	0.18	positive
Dennstaedtia davallioides	1	0.07	0	0.00	positive
Dichondra repens	2	0.57	3	0.32	positive
Doodia aspera	2	0.86	3	0.43	positive
Entolasia marginata	2	0.79	2	0.20	positive
Eucalyptus botryoides	4	0.50	4	0.12	positive
Eucalyptus pilularis	5	0.93	4	0.10	positive
Eupomatia laurina	2	0.50	2	0.32	positive
Geitonoplesium cymosum	2	0.93	1	0.61	positive
Glochidion ferdinandi	2	0.50	2	0.09	positive
Glycine clandestina	2	0.57	2	0.21	positive
Hibbertia dentata	2	0.57	2	0.12	positive
Livistona australis	2	0.50	2	0.49	positive
Lomandra longifolia	3	0.93	2	0.42	positive
Poa labillardieri var. labillardieri	3	0.57	3	0.26	positive
Polyscias sambucifolia subsp. A	3	0.14	0	0.00	positive
Rapanea variabilis	3	0.57	2	0.36	positive
Syncarpia glomulifera subsp. glomulifera	4	0.79	4	0.14	positive
Synoum glandulosum subsp. glandulosum	3	0.71	2	0.38	positive
Tylophora barbata	2	0.93	2	0.30	positive

MU17 Tall Open Gully Gum Forest

❑ *DESCRIPTION*

Tall Open Gully Gum Forest occu rs on exposed slopes and crests on Narrabeen Shale and Sand stone above the escarpment in the catchments of Avon and Cordeaux. *Eucalyptus smithii* and *E. piperita* form the dominant canopy species with occasional occurrences of *E. cypellocarpa and E. muelleriana*. A tall small tree layer comprising *Acacia binervata* is a common feature. T he shrub layer is othe rwise sparse with scattered individuals of *Notelaea venosa*, *Goodenia ovata*, *Synoum glandulosum* subsp. *glandulosum*, *Livistona australis* and *Elaeocarpus reticulatus* sometimes found. The ground cover is a prominent cover of *Lomandra longifolia*, *Pteridium esculentum*, *Calochlaena dubia*, *Dianella caerulea* and *Lepidosperma laterale*. Vin es and twiners are common and i nclude *Eustrephus latifolius*, *Pandorea pandorana* subsp. *pandorana* and *Smilax australis.*

Tall Open Gully Gum forest shares many species with other tall open forests located on shale derived soils of the catchment. It repre sents the drier end of the gradient from Moist Gully Gum Forest (Map Unit 8) a s a result of its exposure to fire and drying winds.

❑ *FLORISTIC SUMMARY*

Number of Sites: 5

Trees: 25-35m tall. Mean Projected Canopy Cover 35%

Eucalyptus smithii, Eucalyptus piperita, Eucalyptus cypellocarpa, Eucalyptus muelleriana, Eucalyptus elata

Small Trees and Shrubs: 2-5m tall. Mean Projected Shrub Cover 25%

Acacia binervata, Notelaea venosa, Goodenia ovata, Synoum glandulosum subsp. *glandulosum, Livistona australis, Acmena smithii*

Ground covers: 0-1 m tall. Mean Projected Ground Cover 15%

Lomandra longifolia, Pteridium esculentum, Lepidosperma laterale, Oplismenus imbecillis, Dianella caerulea, Calochlaena dubia

Vines and Twiners

Hibbertia dentata, Eustrephus latifolius, Pandorea pandorana subsp. *pandorana, Smilax australis, Tylophora barbata, Cissus hypoglauca*

❑ *KEY IDENTIFYING FEATURES*

Easily recognisable features to assist in identifying this map unit are:

- A tall open forest dominated by Gully gum (*Eucalyptus smithii*) and Sydney peppermint (*E. piperita*).
- Prominent stratum of Two-veined hickory (*Acacia binervata*).
- Open forest with dense ground cover with Spiny-head ed mat-rush (*Lomandra longifolia*), Bracken (*Pteridium esculentum*) and *Calochlaena dubia.*
- A high diversity of vines and twine rs that include Bearded tylophora (*Tylophora barbata*), Twining guinea-flower (*Hibbertia dentata*) and Wonga vine (*Pandorea pandorana* subsp. *pandorana*).

❑ *EXAMPLE LOCATIONS*

Fire Trail 15A, Avon Catchment

❑ *CONSERVATION STATUS*

RESERVATION STATUS

Tenure	Study Area (ha)	Proportion of Total (%)	Sydney Basin Bioregion (ha/%)
National Park Estate	8.00	1.9	8 (0.7)
Water Catchment	302.28	73.5	1151 (99)
State Forest	0	0	
Wollongong City Council Reserves	0	0	
Reserved Subtotal	310.28	75.4	
Other	101.22	24.6	
Total	411.50	100	1160

CONDITION ASSESSMENT

Disturbance Class	Area (ha)	Proportion Extant (%)
A Light	381.89	92.6
B Moderate	10.38	2.5
C Heavy	17.09	4.2
Scattered Trees	2.84	0.7
Total	411.50	100

❑ *THREATENED PLANT SPECIES*

None recorded

❑ *DIAGNOSTIC SPECIES*

Species Name	Group Score	Group Freq	Non Group Score	Non Group Freq	Fidelity Class
Carex declinata	1	0.20	0	0.00	positive
Cissus hypoglauca	2	0.60	2	0.04	positive
Dianella caerulea	2	0.80	2	0.29	positive
Elaeocarpus reticulatus	2	0.60	1	0.08	positive
Eucalyptus piperita	3	0.80	3	0.33	positive
Eucalyptus smithii	3	1.00	3	0.01	positive
Eustrephus latifolius	2	1.00	1	0.12	positive
Gonocarpus teucrioides	2	0.60	2	0.36	positive
Goodenia ovata	2	0.80	2	0.01	positive
Hibbertia dentata	2	0.80	2	0.06	positive
Hydrocotyle peduncularis	2	0.60	2	0.03	positive
Lepidosperma laterale	2	0.80	1	0.32	positive

Species Name	Group Score	Group Freq	Non Group Score	Non Group Freq	Fidelity Class
Lomandra longifolia	3	0.80	2	0.43	positive
Microlaena stipoides var. stipoides	2	0.60	1	0.11	positive
Morinda jasminoides	2	0.60	1	0.04	positive
Notelaea venosa	2	1.00	1	0.04	positive
Notothixos subaureus	2	0.20	0	0.00	positive
Oplismenus imbecillis	2	0.80	1	0.04	positive
Pandorea pandorana subsp. pandorana	2	1.00	1	0.04	positive
Pteridium esculentum	2	0.80	2	0.40	positive
Smilax australis	2	0.80	1	0.09	positive
Synoum glandulosum subsp. glandulosum	2	0.80	1	0.05	positive
Tylophora barbata	2	0.80	2	0.10	positive
Corymbia gummifera	0	0.00	2	0.52	negative
Entolasia stricta	2	0.20	2	0.54	negative

MU18 Tall Open Peppermint-Blue Gum Forest

❑ *DESCRIPTION*

Tall Open Peppermint-Blue Gum Forest is a tall to very tall (up to 40 metres) open forest growing on broad crests and slopes on Narrabeen Sandstone and Shale. *Eucalyptus piperita* is a consistent member of the tree layer as either a canopy dominant or associate to *either E. salignaXbotryoides*, *E. cypellocarpa* or *E. globoidea*. Like other Tall Open Forests in the catchment, the understorey composition presents the most identifiable feature of this community. An abundant ground cover of grasses and ferns is typical in this forest with only a sparse shrub and small tree layer present. Species diversity in the ground cover is generally low and is dominated by *Lomandra longifolia*, *Gahnia sieberi*, *Entolasia stricta*, *Calochlaena dubia*, *Pteridium esculentum, Dianella caerulea* and *Hibbertia dentata.* A small tree layer comprising *Acacia binervata*, *Syncarpia glomulifera* subsp. *glomulifera* and *Acmena smithii* occur occasionally at low abundance, with small shrubs including *Notelaea longifolia, Elaeocarpus reticulatus*, *Leucopogon lanceolatus* var. *lanceolatus*, *Tristaniopsis collina* and the palm *Livistona australis* also present.

Tall Open Peppermint-Blue Gum Forest occurs at elevations above 350 metres. The variable nature of the Narrabeen group geology between sandstones, mudrocks and shales influences the local composition and structure of this community. Similar communities are not described for regions north or south of the Woronora Plateau (NPWS, 2000a, 2000b).

❑ *FLORISTIC SUMMARY*

Number of sites: 9

Trees: 30-40m tall. Mean Projected Canopy Cover 45%

Eucalyptus piperita, Eucalyptus salignaXbotryoides, Eucalyptus cypellocarpa, Eucalyptus pilularis, Eucalyptus globoidea

Small Trees: 5-15m tall. Mean Projected Canopy Cover 5%

Acacia binervata, Syncarpia glomulifera subsp. *glomulifera*

Shrubs: 1-5m tall. Mean Projected Canopy Cover 15%

Notelaea longifolia, Elaeocarpus reticulatus, Leucopogon lanceolatus var. *lanceolatus, Tristaniopsis collina, Persoonia linearis, Pultenaea blakelyi, Cyathea australis, Livistona australis, Acmena smithii, Banksia spinulosa* var. *spinulosa*

Ground Covers: 0-0.5m tall. Mean Projected Canopy Cover 80%

Lomandra longifolia, Gahnia sieberi, Entolasia stricta, Calochlaena dubia, Pteridium esculentum, Dianella caerulea

Vines & Climbers:

Smilax australis, Cassytha pubescens, Tylophora barbata

❑ *KEY IDENTIFYING FEATURES*

Easily recognisable features to assist in identifying this map unit are:

- Tall to very tall forest dominated by Sydney peppermint (*Eucalyptus piperita*) and Blue Gum (*E. salignaXbotryoides*).
- Open understorey characterised by a dense fern layer (*Calochlaena dubia* and *Pteridium esculentum*) with Spiny-headed mat-rush (*Lomandra longifolia*) and Wiry panic (*Entolasia stricta*).
- Occupies exposed locations on crests and slopes underlain by Narrabeen Sandstone and Shale.

❑ *EXAMPLE LOCATIONS*

Upper Cordeaux on Kembla West Road; North eastern slopes of Lake Cataract; Fire Trail 8D, Cordeaux Catchment

❑ *CONSERVATION STATUS*

RESERVATION STATUS

Tenure	Study Area (ha)	Proportion of Total (%)	Sydney Basin Bioregion (ha/%)
National Park Estate	3.43	2.9	3.5 (0.2)
Water Catchment	73.46	61.7	1549 (100)
State Forest	0.16	0.1	
Wollongong City Council Reserves	0	0	
Reserved Subtotal	77.05	64.7	
Other	42.06	35.3	
Total	119.11	100	1552

CONDITION ASSESSMENT

Disturbance Class	Area (ha)	Proportion Extant (%)
A Light	96.48	81.0
B Moderate	20.20	17.0
C Heavy	2.43	2.0
Scattered trees	0	0
Total	119.11	100

❑ *THREATENED PLANT SPECIES*

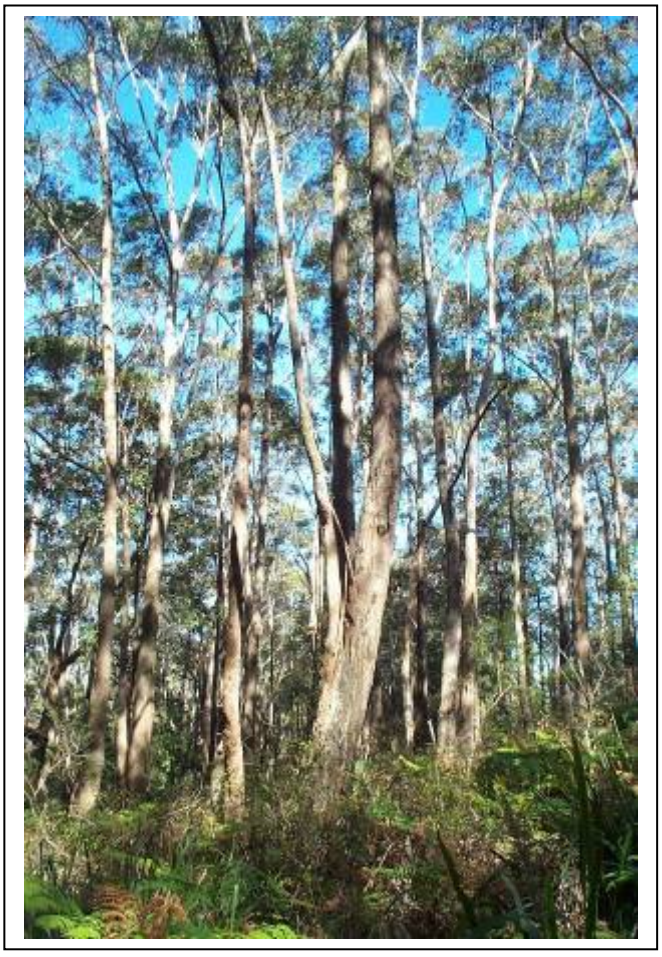
Lomandra fluviatilis (3R)

❑ *DIAGNOSTIC SPECIES*

Species Name	Group Score	Group Freq	Non Group Score	Non Group Freq	Fidelity Class
Acacia binervata	3	0.50	2	0.12	positive
Caladenia catenata	1	0.13	0	0.00	positive
Calochlaena dubia	6	0.75	2	0.11	positive
Cassytha pubescens	2	0.50	2	0.20	positive
Dianella caerulea	2	0.63	2	0.31	positive
Endiandra sieberi	3	0.13	0	0.00	positive
Entolasia stricta	2	0.63	2	0.49	positive
Eucalyptus piperita	4	0.88	3	0.37	positive
Hibbertia dentata	2	0.88	2	0.06	positive
Leucopogon lanceolatus var. lanceolatus	2	0.50	2	0.21	positive
Lomandra longifolia	2	1.00	2	0.44	positive
Melaleuca hypericifolia	2	0.13	0	0.00	positive
Notelaea longifolia forma longifolia	2	0.50	2	0.05	positive
Persoonia glaucescens	2	0.13	0	0.00	positive
Pteridium esculentum	2	0.88	2	0.39	positive
Smilax australis	2	0.50	2	0.08	positive
Corymbia gummifera	3	0.25	2	0.55	negative

MU19 Tall Open Blackbutt Forest

❑ *DESCRIPTION*



Tall Open Blackbutt Forest occurs on Narrabeen Shales and Sandstones along the western edge of the Study Area north from Mt. Keira. *Eucalyptus pilularis* is the most frequently recorded canopy species, most often in association with *Syncarpia glomulifera* subsp. *glomulifera* and less frequently *E. piperita* and *E. saligna*. The composition of the understorey appears variable, particularly as the soil changes between shale and sandstone derived materials. Where the former dominates, and fire is excluded, a moist assemblage develops that is strongly related to Blackbutt Forests found along the northern escarpment. Examples of these are patchy as much of this community experiences frequent burning through hazard reduction and arson. The most frequently encountered understorey is one characterised by taller small trees such as *Acacia binervata* and shrubs such as *Notelaea longifolia* f. *longifolia*, *Persoonia linearis* and *Leucopogon lanceolatus* var. *lanceolatus*. Ground cover is typical of tall open forests of the catchments and is dominated by *Lomandra longifolia*, *Pteridium esculentum* and *Calochlaena dubia*. Twiners such as *Smilax glyciphylla* and *Hibbertia dentata* are common. Where soil moisture is improved, the diversity of herbs increases to include *Dichondra repens*, *Pratia purpurascens*, *Hydrocotyle laxiflora*, *Viola hederacea* and *Desmodium varians*, as well as a greater number of vines such as *Eustrephus latifolius* and *Pandorea pandorana* subsp. *pandorana.* On Narrabeen Sandstones, the soils are well drained and far less fertile. An obvious transition can be seen where the understorey includes sandstone species such as *Banksia serrata* and *Leptospermum polygalifolium* subsp. *polygalifolium*.

Map Unit 15 shares strong similarities with Blackbutt Forests found on the shale influenced soils that occupy valley slopes of the Hacking River in Royal National Park.

❑ *FLORISTIC SUMMARY*

Number of Sites: 5

Trees: 25-35m tall. Mean Projected Canopy Cover 35%

Eucalyptus pilularis, Syncarpia glomulifera subsp. *glomulifera, Eucalyptus piperita, Eucalyptus saligna (Xbotryoides)*

Small Trees and Shrubs: 2-5m tall. Mean Projected Shrub Cover 25%

Acacia binervata, Notelaea longifolia var. *longifolia, Persoonia linearis, Leucopogon lanceolatus, Elaeocarpus reticulatus, Livistona australis*

Ground covers: 0-1 m tall. Mean Projected Ground Cover 15%

Lomandra longifolia, Dianella caerulea, Pteridium esculentum, Calochlaena dubia, Dichelachne rara and less frequently *Dichondra repens, Pratia purpurascens, Viola hederacea*

Vines and Twiners

Hibbertia dentata, Smilax glyciphylla, Clematis aristata, Eustrephus latifolius, Pandorea pandorana subsp. *pandorana*

❑ *KEY IDENTIFYING FEATURES*

Easily recognisable features to assist in identifying this map unit are:

- A tall open forest dominated by Blackbutt (*Eucalyptus pilularis*) and Turpentine (*Syncarpia glomulifera* subsp. *glomulifera*) and less frequently Sydney peppermint (*E. piperita*).
- Prominent stratum of Two-veined hickory (*Acacia binervata*).
- Open Forest with dense ground cover Spiny-headed mat-rush (*Lomandra longifolia*), and the ferns *Pteridium esculentum* and *Calochlaena dubia*.
- Located on Narrabeen Group Geology between Bulli Pass and Mt. Keira.

❑ *EXAMPLE LOCATIONS*

Fire Trail 7A, Cataract Catchment, Fire Trail 7 D (Sandstone influence understorey); Clive Bissell Drive, western side of Road.

❑ *CONSERVATION STATUS*

RESERVATION STATUS

Tenure	Study Area (ha)	Proportion of Total (%)	Sydney Basin Bioregion (ha/%)
National Park Estate	0.92	0.6	1422 (59)
Water Catchment	20.66	14.5	969 (40)
State Forest	0	0	
Wollongong City Council Reserves	0	0	
Reserved Subtotal	21.58	15.1	
Other	120.91	84.9	
Total	142.49	100	2410

CONDITION ASSESSMENT

Disturbance Class	*Area (ha)*	*Proportion Extant (%)*
A Light	*43.52*	*30.5*
B Moderate	*94.73*	*66.5*
C Heavy	*4.25*	*3.0*
Scattered Trees	*0*	*0*
Total	*142.49*	*100*

❑ *THREATENED PLANT SPECIES*

Pultenaea aristata (V)

❑ *DIAGNOSTIC SPECIES*

Species Name	Group Score	Group Freq	Non Group Score	Non Group Freq	Fidelity Class
Calochlaena dubia	3	0.50	2	0.14	positive
Dianella caerulea	2	1.00	2	0.29	positive
Eucalyptus pilularis	3	0.75	3	0.06	positive
Eucalyptus piperita	4	0.50	3	0.34	positive
Eucalyptus saligna	2	0.50	3	0.04	positive
Hibbertia dentata	2	0.75	2	0.06	positive
Leucopogon lanceolatus var. lanceolatus	3	0.50	2	0.21	positive
Lomandra longifolia	3	1.00	2	0.43	positive
Notelaea longifolia forma longifolia	2	0.75	1	0.05	positive
Pteridium esculentum	2	0.75	2	0.40	positive
Syncarpia glomulifera subsp. glomulifera	2	0.75	3	0.03	positive
Corymbia gummifera	0	0.00	2	0.52	negative
Entolasia stricta	2	0.25	2	0.54	negative

MU20 Tall Blackbutt-Apple Shale Forest

❑ *DESCRIPTION*

Tall Blackbutt-Apple Shale Forest occurs on remnant shale caps in the north of the Study Area with several patches between Helensburgh and Garawarra in Royal National Park. *Eucalyptus pilularis* is the dominant canopy species in the community, although several additional species are equally common at much lower abundance. These include *Angophora costata*, *Eucalyptus piperita* and *Corymbia gummifera*. *Syncarpia glomulifera* subsp. *glomulifera* and *Eucalyptus botryoides* may be locally abundant particularly in areas in Royal National Park, though these are not present in the Woronora Catchment. The shrub layer is characterised by *Allocasuarina littoralis*, *Leucopogon lanceolatus* var. *lanceolatus*, *Persoonia linearis*, *Leptospermum polygalifolium* subsp. *polygalifolium*, *Leptomeria acida* and Acacias (most commonly *A. linifolia*). The shrub layer may also include occasional *Livistona australis*, although this is more often amongst the ground layer. The ground layer is one of the more distinctive features because it supports a dense cover of ferns, grasses, herbs, rushes and lilies. A fern layer of *Calochlaena dubia* and *Pteridium esculentum* is frequently recorded. Grasses including *Entolasia stricta* and *Imperata cylindrica* var. *major* are always present amongst an abundant cover of the rush *Lomandra longifolia.* The lilies (*Doryanthes excelsa* and *Dianella caerulea*), herbs (*Pratia purpurascens* and *Viola hederacea*) and twiners, such as *Smilax glyciphylla* and *Hibbertia dentata*, contribute to the verdant ground cover.

Tall Blackbutt-Apple Shale Forest forms a close association with other remnant shale forests found across the Woronora Plateau. It is most similar to O'Hares Creek Shale Forest. Higher rainfall levels found east of the Helensburgh area are likely to be the main contributor to the floristic differences between these two communities. Keith has provisionally identified this community as Tall Dry Forest (Garawarra) in Royal National Park.

❑ *FLORISTIC SUMMARY*

Number of Sites: 7

Trees: 25-35m tall. Mean Projected Canopy Cover 45%

Eucalyptus pilularis, Angophora costata, Eucalyptus piperita, Corymbia gummifera, Syncarpia glomulifera subsp. *glomulifera, Eucalyptus botryoides, Eucalyptus globoidea, Eucalyptus resinifera* subsp. *resinifera*

Shrubs: 2-8m tall. Mean Projected Canopy Cover 35%

Leucopogon lanceolatus var. *lanceolatus, Allocasuarina littoralis, Leptospermum polygalifolium* subsp. *polygalifolium, Persoonia linearis, Acacia linifolia, Breynia oblongifolia, Kunzea ambigua, Lomatia silaifolia*

Ground covers: 0-1 m tall. Mean Projected Canopy Cover 20%

Lomandra longifolia, Doryanthes excelsa, Entolasia stricta, Entolasia marginata, Calochlaena dubia, Pteridium esculentum, Lomandra obliqua, Dianella caerulea, Pratia purpurascens, Livistona australis, Cassytha pubescens, Caladenia catenata, Hibbertia dentata, Kennedia rubicunda, Lepidosperma laterale, Viola hederacea, Smilax glyciphylla.

❑ *KEY IDENTIFYING FEATURES*

Easily recognisable features to assist in identifying this map unit are:

- Located only within Woronora Catchment on the eastern edge adjoining the Princes Highway and F6 Freeway interchange. Occurs on top of a gentle rise.
- Tall Blackbutt (*Eucalyptus pilularis*), with low cover of Smooth-barked apple (*Angophora costata*) and Sydney peppermint (*E. piperita*).
- A very dense ground cover of ferns, grasses, lilies and rushes. These include Spiny-headed mat-rush (*Lomandra longifolia)*, Gymea lily (*Doryanthes excelsa*), Bracken (*Pteridium esculentum*) and Common ground fern (*Calochlaena dubia*) and the grasses *Entolasia stricta* and *Imperata cylindrica* var. *major.*
- A moderately open shrub layer dominated by Black sheoak (*Allocasuarina littoralis*) and Tea-tree (*Leptospermum polygalifolium* subsp. *polygalifolium*) and Lance-leaf beard-heath (*Leucopogon lanceolatus* var. *lanceolatus*).

❑ *EXAMPLE LOCATIONS*

F6 Freeway and Princes Highway Interchange, Woronora Catchment; Helensburgh; Garawarra (Royal National Park)

❑ *CONSERVATION STATUS*

RESERVATION STATUS

Tenure	Study Area (ha)	Proportion of Total (%)	Sydney Basin Bioregion (ha/%)
National Park Estate	6.47	4.0	345 (91)
Water Catchment	16.62	10.2	25 (6)
State Forest	0	0	
Wollongong City Council Reserves	0	0	
Reserved Subtotal	23.09	14.2	
Other	139.91	85.8	
Total	163.00	100	379

CONDITION ASSESSMENT

Disturbance Class	Area (ha)	Proportion Extant (%)
A Light	103.89	63.7
B Moderate	40.84	25.1
C Heavy	14.51	8.9
Scattered Trees	3.76	2.3
Total	163.00	100

❑ *THREATENED PLANT SPECIES*

None recorded

❑ *DIAGNOSTIC SPECIES*

Species Name	Group Score	Group Freq	Non Group Score	Non Group Freq	Fidelity Class
Eucalyptus pilularis	3	0.71	3	0.06	positive
Leptospermum polygalifolium subsp. polygalifolium	2	0.86	2	0.17	positive
Lomandra longifolia	2	1.00	2	0.43	positive
Melaleuca hypericifolia	2	0.14	0	0.00	positive
Olearia microphylla	1	0.14	0	0.00	positive
Pratia purpurascens	2	0.57	2	0.10	positive
Pteridium esculentum	3	0.86	2	0.40	positive
Xanthorrhoea macronema	3	0.14	0	0.00	positive
Corymbia gummifera	1	0.57	2	0.52	negative
Entolasia stricta	2	1.00	2	0.53	constant
Acacia binervata	1	0.56	2	0.10	uninformative

MU21 O'Hares Creek Shale Forest

❑ *DESCRIPTION*

O'Hares Shale Forest forms part of a network of vegetation communities that occupy remnant shale soils that lie as isolated caps above the extensive sandstone plateau. The forest is dominated by *Eucalyptus piperita*, *E. globoidea* and *Angophora costata*. The latter species can at times be the dominant canopy species. The trees are distinctively taller (often greater than 30 metres) than those found in the surrounding sandstone woodland vegetation. The shrub layer is variable in density and height but is characterised by *Acacia binervata, A. longifolia* subsp. *longifolia*, *Leucopogon lanceolatus* var. *lanceolatus* and *Banksia spinulosa* var. *spinulosa*. The ground cover is often the distinguishing feature of the community with an impressive cushion of ferns, lilies, grasses and rushes that include the species such as *Calochlaena dubia*, *Pteridium esculentum*, *Doryanthes excelsa*, *Dianella caerulea*, *Lomandra longifolia, Blechnum cartilagineum*, *Entolasia stricta* and *Imperata cylindrica* var. *major*. Low climbing vines and twiners are also present including *Clematis aristata*, *Eustrephus latifolius* and *Smilax glyciphylla*.

O'Hares Creek Shale Forest is found between the watersheds of the O'Hares and Woronora Catchments. A single patch occurs within the Study Area east of the Princes Highway on Maddens Plains. The depth of the shale soil is often variable and as a consequence greater influence of sandstone vegetation is found on the edge of larger shale patches or throughout smaller isolated examples.

This community is listed under the Threatened Species Conservation Act, 1995, as an Endangered Ecological Community. Keith (1994) notes that O'Hares Creek Shale Forest was once likely to be more extensive across much of the Darkes Forest and Helensburgh Areas extending north to Heathcote. Consequently the Catchments of Woronora, O'Hares and Cataract conserve the majority of the remaining examples.

❑ *FLORISTIC SUMMARY*

Number of Sites: ***11***

Trees: 25-35m tall. Mean Projected Canopy Cover 45%

Eucalyptus globoidea, Eucalyptus piperita, Angophora costata, Corymbia gummifera, Eucalyptus sieberi

Shrubs: 2-8m tall. Mean Projected Canopy Cover 35%

Acacia binervata, Acacia longifolia, Leucopogon lanceolatus var. *lanceolatus, Banksia spinulosa* var. *spinulosa*

Ground covers: 0-1 m tall. Mean Projected Canopy Cover 20%

Calochlaena dubia, Pteridium esculentum, Doryanthes excelsa, Dianella caerulea, Lomandra longifolia, Blechnum cartilagineum, Entolasia stricta, Imperata cylindrica var. *major*

Vines and Twiners:

Clematis aristata, Eustrephus latifolius, Smilax glyciphylla

❑ *KEY IDENTIFYING FEATURES*

Easily recognisable features to assist in identifying this map unit are:

- Tall straight trees usually Sydney peppermint (*Eucalyptus piperita*), White stringybark (*E. globoidea*) and Smooth-barked apple (*Angophora costata*).
- A dense ground cover of ferns (*Calochlaena dubia*, *Pteridium esculentum*), Lilies (*Doryanthes excelsa*, *Dianella caerulea*) and Spiny-headed matt-rush (*Lomandra longifolia*).
- A variable understorey density that comprises a suite of Acacia species that includes Two-veined hickory (*Acacia binervata*) and Sydney golden wattle (*A. longifolia* subsp. *longifolia*) with Lance-leaf beard-heath (*Leucopogon lanceolatus* var. *lanceolatus*).
- A deeper reddish brown soil that is generally damp and clay like in texture forming isolated caps on broad crests, knolls and ridges.

❑ *EXAMPLE LOCATIONS*

Darkes Forest; Fire Trails 9E in O'Hares and Woronora Catchments; Trail 7 in Cataract.

❑ *CONSERVATION STATUS*

Listed as an Endangered Ecological Community under Part 3 of Schedule 1 of the Threatened Species Conservation Act (1995).

RESERVATION STATUS

Tenure	Study Area (ha)	Proportion of Total (%)	Sydney Basin Bioregion (ha/%)
National Park Estate	0	0	23 (8)
Water Catchment	0	0	263 (92)
State Forest	0	0	
Wollongong City Council Reserves	0	0	
Reserved Subtotal	0	0	
Other	2.67	100	
Total	2.67	100	286

CONDITION ASSESSMENT

Disturbance Class	Area (ha)	Proportion Extant (%)
A Light	2.67	100
B Moderate	0	0
C Heavy	0	0
Scattered Trees	0	0
Total	2.67	100

❑ *THREATENED PLANT SPECIES*

None recorded

❑ *DIAGNOSTIC SPECIES*

Species Name	Group Score	Group Freq	Non Group Score	Non Group Freq	Fidelity Class
Banksia spinulosa var. spinulosa	3	0.55	2	0.45	positive
Billardiera scandens	2	0.73	1	0.28	positive
Blechnum cartilagineum	3	0.82	2	0.09	positive
Calochlaena dubia	4	0.82	2	0.12	positive
Clematis aristata	3	0.91	1	0.09	positive
Dianella caerulea	2	1.00	2	0.28	positive
Doryanthes excelsa	4	0.64	2	0.13	positive
Eucalyptus globoidea	4	0.91	2	0.10	positive
Eucalyptus piperita	3	0.91	3	0.33	positive
Eustrephus latifolius	2	0.55	1	0.12	positive
Glycine clandestina	2	0.73	1	0.12	positive
Gonocarpus teucrioides	2	0.55	2	0.36	positive
Imperata cylindrica var. major	2	0.73	1	0.10	positive
Kennedia rubicunda	2	0.64	1	0.05	positive
Lagenifera stipitata	2	0.64	2	0.08	positive
Lepidosperma laterale	2	0.55	1	0.32	positive
Leucopogon lanceolatus var. lanceolatus	2	0.91	2	0.20	positive
Lomandra longifolia	3	1.00	2	0.42	positive
Lomatia silaifolia	2	0.55	2	0.40	positive
Persoonia linearis	2	0.73	1	0.22	positive
Phyllanthus hirtellus	2	0.64	2	0.21	positive
Pratia purpurascens	2	0.64	2	0.10	positive
Pteridium esculentum	3	1.00	2	0.39	positive
Smilax glyciphylla	2	0.55	1	0.24	positive
Viola hederacea	2	0.73	2	0.12	positive
Corymbia gummifera	3	0.55	2	0.52	constant
Entolasia stricta	3	0.82	2	0.53	constant

MU22 Highlands Shale Tall Open Forest

❑ *DESCRIPTION*

Highlands Shale Tall Open Forest occurs at elevations greater than 600 metres on soils that are heavily influenced by shale material. The depth of the shale soil and its proximity to adjoining basalt and sandstone parent material varies the composition of the overstorey species while having less affect on the floristic composition overall. The thread that links the sites defining this community is shared with other tall open forests in the Study Area. Tall *Eucalyptus piperita* and *E. globoidea* are frequently recorded, with the latter as an associate species. There are a wide variety of other species, unique to these higher elevations that appear to respond to slight changes in soil composition. *Eucalyptus obliqua* and *E. cypellocarpa* occur on deeper shale soils in combination with *E. piperata*. At higher elevations towards Mittagong, the forest comprises *Eucalyptus quadrangulata*, *E. elata* and *E. punctata*, with *E. smithii* occurring in localised patches. *Eucalyptus radiata* subsp. *radiata* can occur throughout these combinations at low abundance.

Acacia binervata forms a distinctive small tree stratum, infrequently occurring with *A. melanoxylon* or *Allocasuarina torulosa*. The smaller shrub layer is characterised by *Leucopogon lanceolatus* var. *lanceolatus* with other species such as *Bursaria spinosa*, *Coprosma quadrifida* and *Helichrysum elatum* less common. At sites with greater sandstone influence, *Leptospermum polygalifolium* subsp. *polygalifolium*, *Persoonia linearis* and *Banksia spinulosa* var. *spinulosa* occur in this stratum. Ground cover is invariably a cover of *Lomandra longifolia*, *Pteridium esculentum* and *Dianella caerulea* in combination with herbs such as *Viola hederacea*, *Pratia purpurascens*, *Dichondra repens* and *Hydrocotyle laxiflora*.

❑ *FLORISTIC SUMMARY*

Number of Sites: 16

Trees: 25-35m tall. Mean Projected Canopy Cover 45%

Eucalyptus piperita, Eucalyptus globoidea, Eucalyptus radiata subsp. *radiata, Eucalyptus obliqua, Eucalyptus cypellocarpa, Eucalyptus quadrangulata, Eucalyptus elata, Eucalyptus agglomerata, Eucalyptus punctata, Eucalyptus amplifolia* subsp. *amplifolia, Eucalyptus dives, Eucalyptus smithii, Eucalyptus ovata*

Small Trees

Acacia binervata, Allocasuarina torulosa, Acacia melanoxylon

Shrubs: 2-8m tall. Mean Projected Canopy Cover 35%

Acacia longifolia subsp. *longifolia, Leucopogon lanceolatus* var. *lanceolatus, Leptospermum polygalifolium* subsp. *polygalifolium, Banksia spinulosa* var. *spinulosa*

Ground covers: 0-1 m tall. Mean Projected Canopy Cover 20%

Calochlaena dubia, Pteridium esculentum, Dianella caerulea, Lomandra longifolia, Entolasia marginata, Viola hederacea, Pratia purpurascens, Dichondra repens, Gonocarpus teucrioides, Hydrocotyle laxiflora, Hibbertia aspera

Vines and Twiners:

Glycine clandestina, Hibbertia scandens

❑ *KEY IDENTIFYING FEATURES*

Easily recognisable features to assist in identifying this map unit are:

- Tall straight trees usually Sydney peppermint (*Eucalyptus piperita*), White stringybark (*E. globoidea*) sometimes with Messmate (*E. obliqua*) and Monkey gum (*E. cypellocarpa*) to the east and White-topped box (*E. quadrangulata*), Grey gum (*Eucalyptus punctata*) and River peppermint (*Eucalyptus elata*) in the west.
- An obvious, dense ground cover of ferns (*Calochlaena dubia, Pteridium esculentum*), *Dianella caerulea* and Spiny-headed mat-rush (*Lomandra longifolia*).
- A small tree layer of Two-veined hickory (*Acacia binervata*) and the characteristic Lance-Leaf beard-heath (*Leucopogon lanceolatus* var. *lanceolatus*) as a smaller shrub.
- High elevations on shale soil or shale influenced sandstone between Robertson and Alpine in the Nepean Catchment.

❑ *EXAMPLE LOCATIONS*

Fire Trail 15 at southern gate and at Macquarie Hill; Tourist Rd Mt Murray; Intersection Fire Trail 2A and Trail 2, Northern Gate of Fire Trail 3

❑ *CONSERVATION STATUS*

Listed as an Endangered Ecological Community under Part 3 of Schedule 1 of the Threatened Species Conservation Act (1995) as part of Southern Highlands Shale Woodlands.

RESERVATION STATUS

Tenure	Study Area (ha)	Proportion of Total (%)	Sydney Basin Bioregion (ha/%)
National Park Estate	3.79	13.7	4 (0.04)
Water Catchment	21.59	78.2	3435 (39)
State Forest	0	0	
Wollongong City Council Reserves	0	0	
Reserved Subtotal	25.38	91.9	
Other	2.23	8.1	
Total	27.61	100	8769

CONDITION ASSESSMENT

Disturbance Class	Area (ha)	Proportion Extant (%)
A Light	27.61	100
B Moderate	0	0
C Heavy	0	0
Scattered Trees	0	0
Total	27.61	100

❑ *THREATENED PLANT SPECIES*

None recorded

❑ *DIAGNOSTIC SPECIES*

Species Name	Group Score	Group Freq	Non Group Score	Non Group Freq	Fidelity Class
Carex fascicularis	2	0.06	0	0.00	positive
Cassinia uncata	1	0.06	0	0.00	positive
Cymbonotus lawsonianus	1	0.06	0	0.00	positive
Dianella caerulea	2	0.75	2	0.28	positive
Dichondra repens	2	0.50	1	0.05	positive
Entolasia marginata	2	0.56	2	0.22	positive
Eucalyptus globoidea	2	0.50	3	0.11	positive
Eucalyptus ovata	4	0.13	0	0.00	positive
Eucalyptus piperita	3	0.75	3	0.33	positive
Galium propinquum	2	0.50	2	0.02	positive
Glycine clandestina	2	0.50	1	0.12	positive
Gonocarpus teucrioides	2	0.69	2	0.35	positive
Hibbertia aspera subsp. aspera	2	0.50	2	0.12	positive
Hibbertia scandens	2	0.50	1	0.09	positive
Hydrocotyle laxiflora	2	0.50	2	0.03	positive
Juncus polyanthemus	1	0.06	0	0.00	positive
Lagenifera stipitata	2	0.56	2	0.08	positive
Leptospermum polygalifolium subsp. polygalifolium	2	0.50	2	0.17	positive
Leucopogon lanceolatus var. lanceolatus	2	1.00	2	0.19	positive
Lomandra longifolia	2	0.88	2	0.42	positive
Persoonia linearis	2	0.50	1	0.22	positive
Poranthera microphylla	2	0.69	2	0.05	positive
Pratia purpurascens	2	0.88	1	0.08	positive
Pteridium esculentum	2	1.00	2	0.39	positive
Tetrarrhena juncea	2	0.56	2	0.05	positive
Viola hederacea	2	0.69	2	0.11	positive
Corymbia gummifera	2	0.06	2	0.53	negative
Entolasia stricta	2	0.13	2	0.55	negative

MU23 Coastal Grassy Red Gum Forest

❑ *DESCRIPTION*

Coastal Grassy Red Gum Forest describes a complex of vegetation occupying the undulating landscapes of the coastal plain and escarpment foothills. *Eucalyptus tereticornis* is the dominant component of the canopy, occurring in combination with *E. eugenioides, Angophora floribunda* and *E. bosistoana*. The ground cover features a dense cover of grasses and herbs including *Dichondra repens, Desmodium varians, Microlaena stipoides* var. *stipoides*, *Oplismenus imbecillis, Commelina cyanea, Pratia purpurascens, Poa labillardieri* var. *labillardieri, Entolasia marginata, Themeda australis, Eragrostis leptostachya* and *Echinopogon ovatus*. This dense ground cover is a consistent feature across a number of floristic variations within this community. Samples of these variations are both limited and in poor condition providing insufficient opportunity to replicate sites within the LGA.

Exposed lower escarpment footslopes between 30 and 200 metres elevation represent the main distribution of this community. A dry grassy open forest occurs on the Gerringong volcanics and Permian siltstones and shales south of Mt. Kembla. Transitions into moister forest occur on protected aspects or where disturbance from grazing or fire has been absent for some time.

At elevations less than 15 metres on alluvium or soil derived from Gerringong Volcanics, a woodland of *Eucalyptus tereticornis* and *Melaleuca styphelioides* may have been extensive. *Eucalyptus tereticornis* dominates in sites near Yallah while associated canopy species in remnants at Wisemans Park, Gwynneville include *E. paniculata* subsp. *paniculata, E. eugenioides* and *Syncarpia glomulifera* subsp. *glomulifera.*

Coastal Grassy Red Gum Forest forms a component of the Illawarra Lowlands Grassy Woodland Endangered Ecological Community listed on Part 3 of Schedule 1 of the Threatened Species Conservation Act (1995). It is likely to have once been extensively distributed across the gently sloping lands and rises on the Permian siltstones and shales, Gerringong Volcanics and Quaternary Alluvium. Clearing has reduced this community to small highly fragmented patches of remnant vegetation. As a result of the open canopy this woodland is highly susceptible to chronic weed infestation particularly by *Lantana camara*.

Sites describing this community were located within areas mapped by Mills (2000) as Red Gum-Stringybark Forest in the Shellharbour LGA. NPWS (2000a) describe a Coastal Grassy Forest (Forest Ecosystem 171) for the South Coast region. This ecosystem appears to share similar canopy species although limited information is provided upon which to reliably compare the diverse understorey. Like the Illawarra community, the original distribution is considered heavily depleted with over 75% cleared. Poor floristic relationships were achieved with site data describing Red Gum-Box communities on the Cumberland Plain in

Western Sydney. Similar communities are not described between the Central Coast and Newcastle (NPWS, 2000b).

❑ *FLORISTIC SUMMARY*

Number of Sites: 17

Trees: 15-22m tall. Mean Projected Canopy Cover 35%

Eucalyptus tereticornis, Eucalyptus eugenioides, Angophora floribunda, Eucalyptus bosistoana

Subcanopy Trees & Shrubs: 4-8m tall. Mean Projected Canopy Cover 25%

Pittosporum undulatum, Breynia oblongifolia, Rapanea variabilis, Acacia maidenii, Melaleuca styphelioides

Ground Covers: 0-1m tall. Mean Projected Canopy Cover 80%

Dichondra repens, Desmodium varians, Microlaena stipoides var. *stipoides, Oplismenus imbecillis, Commelina cyanea, Pratia purpurascens, Poa labillardieri* var. *labillardieri, Entolasia marginata, Themeda australis, Eragrostis leptostachya, Echinopogon ovatus, Chloris divaricata* var. *divaricata, Chloris ventricosa, Carex longebrachiata, Dichopogon strictus, Bothriochloa decipiens, Sporobolus elongatus*

Vines & Climbers:

Eustrephus latifolius, Glycine clandestina, Geitonoplesium cymosum

❑ *KEY IDENTIFYING FEATURES*

Easily recognisable features to assist in identifying this map unit are:

- The dominance of Forest red gum (*Eucalyptus tereticornis*) and Narrow-leaved stringybark (*E. eugenioides*) in the canopy. Coastal grey box (*E. bosistoana*) is unique to this community.
- A grassy understorey and the presence of species such as Tick-trefoil (*Desmodium varians*), Weeping grass (*Microlaena stipoides* var. *stipoides*), Scurvy weed (*Commelina cyanea*), Tussock (*Poa labillardieri* var. *labillardieri*), Hedgehog grass (*Echinopogon ovatus*), Paddock lovegrass (*Eragrostis leptostachya*), Windmill grass (*Chloris divaricata* var. *divaricata*), Bluegrass (*Bothriochloa decipiens*) and Chocolate Lily (*Dichopogon strictus*).

❑ *EXAMPLE LOCATIONS*

Mt. Brown, Dapto; Farmborough Heights; Johnstone Ridge, Calderwood; Wisemans Park, Gwynneville

❑ *CONSERVATION STATUS*

Listed as an Endangered Ecological Community under the Threatened Species Act (1995) as part of Illawarra Lowlands Grassy Woodland

RESERVATION STATUS

Tenure	Study Area (ha)	Proportion of Total (%)	Sydney Basin Bioegion (ha/%)
National Park Estate	0.36	0.0	0.4 (0.03)
Water Catchment	0	0	
State Forest	0	0	
Wollongong City Council Reserves	33.68	4.2	
Reserved Subtotal	34.04	4.2	
Other	763.40	95.7	
Total	797.44	100	>1255

CONDITION ASSESSMENT

Disturbance Class	Area (ha)	Proportion Extant (%)
A Light	15.86	2.0
B Moderate	260.50	32.7
C Heavy	167.36	21.0
Scattered trees	353.72	44.4
Total	797.44	100

❑ *THREATENED PLANT SPECIES*

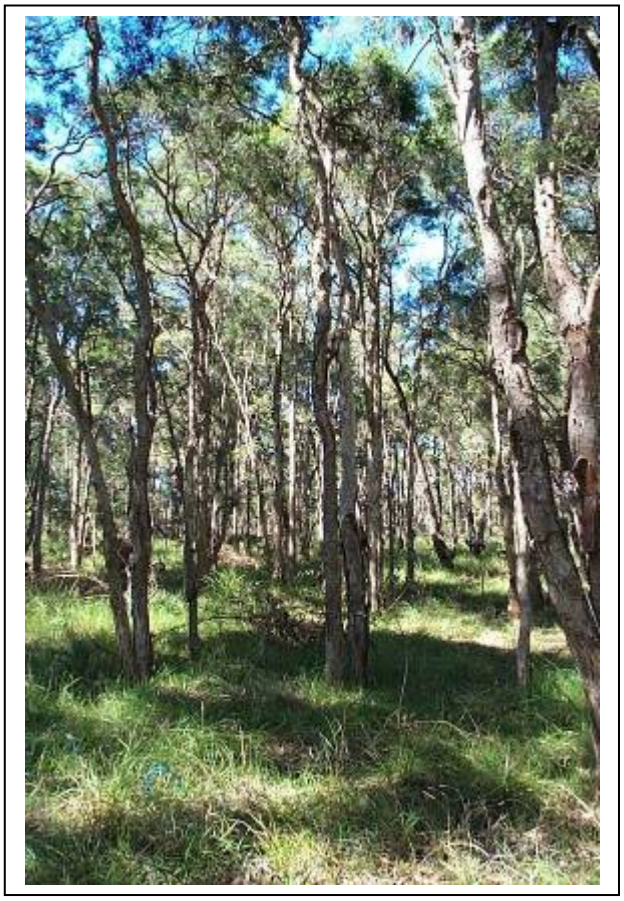
*Pterostylis gibbosa (*E1)

❑ *DIAGNOSTIC SPECIES*

Species Name	Group Score	Group Freq	Non Group Score	Non Group Freq	Fidelity Class
Acacia maidenii	2	0.71	1	0.36	positive
Amyema congener subsp. congener	1	0.06	0	0.00	positive
Aristida ramosa	4	0.12	0	0.00	positive
Austrodanthonia racemosa var. racemosa	2	0.06	0	0.00	positive
Bothriochloa decipiens	2	0.12	0	0.00	positive
Brachychiton populneus subsp. populneus	1	0.06	0	0.00	positive
Bracteantha bracteata	2	0.06	0	0.00	positive
Breynia oblongifolia	2	0.71	1	0.35	positive
Carex longebrachiata	3	0.59	2	0.18	positive
Chloris divaricata var. divaricata	3	0.12	0	0.00	positive
Chloris ventricosa	6	0.06	0	0.00	positive
Commelina cyanea	3	0.88	2	0.28	positive
Cyperus laevis	2	0.53	2	0.06	positive
Davallia solida var. pyxidata	1	0.06	0	0.00	positive
Desmodium varians	3	0.88	1	0.12	positive
Dichelachne rara	1	0.06	0	0.00	positive
Dichondra repens	3	0.94	2	0.28	positive
Dichondra species A	1	0.06	0	0.00	positive
Dichopogon strictus	2	0.12	0	0.00	positive
Digitaria diffusa	1	0.06	0	0.00	positive
Echinopogon ovatus	3	0.53	3	0.02	positive
Einadia hastata	2	0.12	0	0.00	positive
Entolasia marginata	2	0.65	2	0.21	positive
Eragrostis brownii	2	0.06	0	0.00	positive
Eucalyptus bosistoana	4	0.12	0	0.00	positive
Eucalyptus eugenioides	4	0.59	4	0.01	positive
Eucalyptus tereticornis	4	1.00	4	0.07	positive
Geitonoplesium cymosum	2	0.88	1	0.61	positive
Glycine clandestina	2	0.65	2	0.20	positive
Glycine tabacina	2	0.53	2	0.08	positive
Microlaena stipoides var. stipoides	3	0.88	2	0.18	positive
Pittosporum revolutum	2	0.53	1	0.38	positive
Poa labillardieri var. labillardieri	3	0.71	3	0.24	positive
Pratia purpurascens	2	0.59	2	0.12	positive
Rapanea variabilis	2	0.71	2	0.35	positive
Sigesbeckia orientalis subsp. orientalis	2	0.53	1	0.05	positive
Sporobolus elongatus	1	0.06	0	0.00	positive
Themeda australis	4	0.53	2	0.08	positive
Acmena smithii	0	0.00	2	0.51	negative
Doodia aspera	2	0.06	3	0.51	negative
Gymnostachys anceps	2	0.06	2	0.52	negative
Livistona australis	1	0.18	2	0.52	negative
Marsdenia rostrata	1	0.41	2	0.59	negative
Notelaea venosa	2	0.35	3	0.59	negative
Smilax australis	1	0.06	2	0.50	negative

MU24 Lowland Woollybutt-*Melaleuca* Forest

❑ *DESCRIPTION*



Lowland Woollybutt-*Melaleuca* Forest is characterised by the presence of *Eucalyptus longifolia, E. globoidea/E. eugenioides,* a dense subcanopy of *Melaleuca decora* and a grassy understorey. *Eucalyptus tereticornis* occurs only occasionally. Patchy occurrences of *Eucalyptus pilularis* in the canopy represent a minor variation within the Map Unit. This community occurs on flat low-lying Shoalhaven Group sediments at elevations between 10 and 35 metres above sea level. Slope rarely exceeds two degrees. Two sites describing this community occur on geology described as Quaternary Alluvium. Remnant trees of *Eucalyptus longifolia, E. tereticornis* and *Melaleuca decora* remain primarily on Permian rather than Quaternary geologies.

This community shares little floristic similarity with vegetation communities from the broader region to the north and west of the Wollongong LGA. Castlereagh Ironbark Forest, a community occurring on the Cumberland Plain in Western Sydney, supports an assemblage of flora that includes *Eucalyptus longifolia* and *Melaleuca decora*. Some common ground cover species are also shared between these two communities, though marked differences between shrub and canopy species are clearly apparent. These differences were also apparent between sites describing a similarly named community on the Wyong Coastal Plain (Bell, in prep.). To the south in Shellharbour LGA, sites describing Woollybutt-*Melaleuca* Woodland fell within areas mapped by Mills (2000) as Red Gum-Paperbark Forest. NPWS (2000a) does not describe a similar assemblage for the South Coast Region.

Lowland Woollybutt-*Melaleuca* Forest forms a distinct component of the Illawarra Lowlands Grassy Woodland Endangered Ecological Community listed on Part 3 of Schedule 1 of the Threatened Species Conservation Act (1995). This community is likely to have once been extensively distributed across the flat plains and gentle slopes at Bellambi, Fairy Meadow, Unanderra, Dapto and Albion Park. Clearing has reduced this community to small highly fragmented patches of remnant vegetation. Many stands of this map unit have been modified to improve grazing potential through the partial or total removal of the *Melaleuca* subcanopy and understorey shrubs.

❑ *FLORISTIC SUMMARY*

Number of sites: 8

Trees: 12-20m tall. Mean Projected Canopy Cover 30%

Eucalyptus longifolia, Melaleuca decora, Eucalyptus globoidea, Eucalyptus eugenioides, Eucalyptus tereticornis.

Shrubs: 0.5-2m tall. Mean Projected Canopy Cover 25%

Leucopogon juniperinus, Ozothamnus diosmifolius, Acacia falcata, Pultenaea retusa, Daviesia genistifolia, Dodonaea viscosa var. *angustifolia*

Ground Covers: 0-0.5m tall. Mean Projected Canopy Cover 80%

Entolasia stricta, Microlaena stipoides var. *stipoides, Pratia purpurascens, Cheilanthes sieberi* subsp. *sieberi, Echinopogon caespitosus* var. *caespitosus, Lepidosperma laterale, Dianella longifolia, Digitaria parviflora, Eragrostis leptostachya, Cymbopogon refractus, Lomandra longifolia, Dichondra repens, Hypoxis*

hygrometrica, Arthropodium sp. B*, Lagenifera stipitata, Opercularia diphylla, Themeda australis, Imperata cylindrica* var. *major*

Vines & Climbers:

Glycine clandestina, Glycine tabacina, Hardenbergia violacea, Parsonsia straminea, Kennedia rubicunda

❑ *KEY IDENTIFYING FEATURES*

Easily recognisable features to assist in identifying this map unit are:

- The dominance of Woollybutt (*Eucalyptus longifolia*), Paperbark (*Melaleuca decora*) and Narrow-leaved stringybark (*E. globoidea*) in the canopy.
- A grassy understorey and the presence of species such as Poison rock fern (*Cheilanthes sieberi* subsp. *sieberi*), Hedgehog grass (*Echinopogon caespitosus* var. *caespitosus*), Golden star (*Hypoxis hygrometrica*) and Flax lily (*Dianella longifolia*).

❑ *EXAMPLE LOCATIONS*

Sheaffes Road, West Dapto; Albion Park Aerodrome; Duck Creek, Yallah

❑ *CONSERVATION STATUS*

Listed as an Endangered Ecological Community under the Threatened Species Act (1995) as part of Illawarra Lowlands Grassy Woodlands.

RESERVATION STATUS

Tenure	Study Area (ha)	Proportion of Total (%)	Sydney Basin Bioregion (ha/%)
National Park Estate	0	0	0 (0)
Water Catchment	0	0	
State Forest	0	0	
Wollongong City Council Reserves	21.21	4.5	
Reserved Subtotal	21.21	4.5	
Other	452.98	95.5	
Total	474.19	100	>490

CONDITION ASSESSMENT

Disturbance Class	Area (ha)	Proportion Extant (%)
A Light	41.68	8.8
B Moderate	129.67	27.3
C Heavy	108.31	22.8
Scattered trees	194.53	41.0
Total	474.19	100

❑ *THREATENED PLANT SPECIES*

Pterostylis gibbosa (E1)

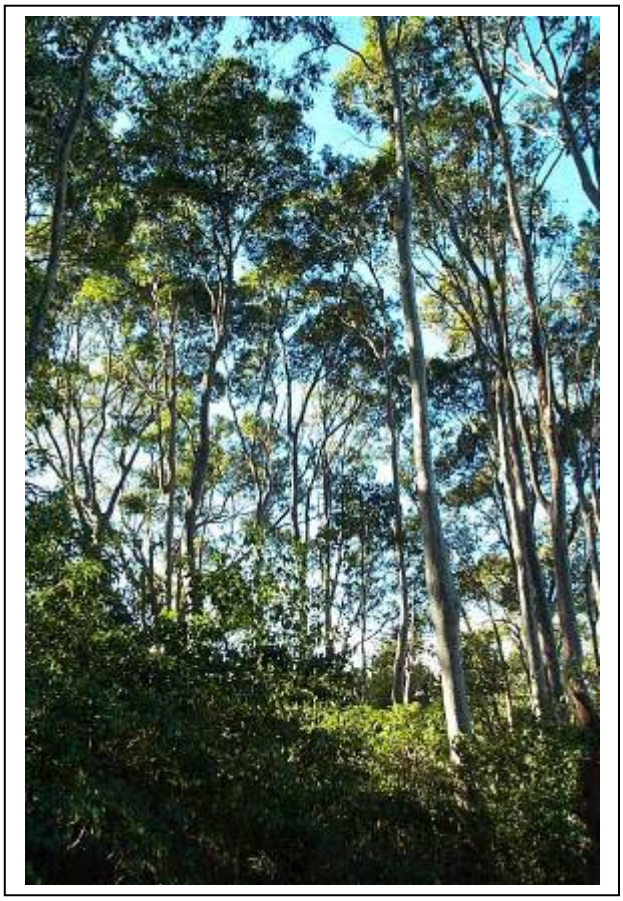
❑ *DIAGNOSTIC SPECIES*

Species Name	Group Score	Group Freq	Non Group Score	Non Group Freq	Fidelity Class
Acacia falcata	1	0.50	0	0.00	positive
Aristida vagans	4	0.10	0	0.00	positive
Arthropodium milleflorum	2	0.10	0	0.00	positive
Arthropodium species B	2	0.80	1	0.02	positive
Austrodanthonia caespitosa	2	0.20	0	0.00	positive
Austrodanthonia pilosa	2	0.10	0	0.00	positive
Cheilanthes sieberi subsp. sieberi	3	0.90	2	0.03	positive

Species Name	Group Score	Group Freq	Non Group Score	Non Group Freq	Fidelity Class
Chorizema parviflorum	2	0.10	0	0.00	positive
Cymbopogon refractus	2	0.70	2	0.05	positive
Daviesia ulicifolia	3	0.20	0	0.00	positive
Dianella longifolia	3	0.50	1	0.05	positive
Dianella revoluta var. revoluta	2	0.10	0	0.00	positive
Dichondra repens	3	0.60	2	0.32	positive
Digitaria parviflora	3	0.60	2	0.03	positive
Digitaria ramularis	2	0.10	0	0.00	positive
Drosera auriculata	2	0.10	0	0.00	positive
Echinopogon caespitosus var. caespitosus	3	0.90	2	0.03	positive
Entolasia stricta	3	1.00	3	0.09	positive
Eragrostis leptostachya	3	0.60	3	0.05	positive
Eucalyptus globoidea	4	0.90	4	0.01	positive
Eucalyptus longifolia	4	1.00	0	0.00	positive
Euchiton sphaericus	1	0.10	0	0.00	positive
Glycine clandestina	3	0.90	2	0.20	positive
Glycine tabacina	2	0.80	2	0.08	positive
Goodenia hederacea subsp. hederacea	2	0.60	1	0.02	positive
Hardenbergia violacea	2	0.60	2	0.03	positive
Hibbertia obtusifolia	2	0.10	0	0.00	positive
Hovea linearis	2	0.10	0	0.00	positive
Hypoxis hygrometrica	3	0.50	3	0.01	positive
Imperata cylindrica var. major	3	0.60	2	0.12	positive
Kunzea ambigua	2	0.10	0	0.00	positive
Lagenifera stipitata	2	0.70	1	0.02	positive
Laxmannia gracilis	1	0.30	0	0.00	positive
Lepidosperma laterale	3	0.70	1	0.11	positive
Leucopogon juniperinus	3	0.70	2	0.02	positive
Lomandra longifolia	3	0.80	2	0.44	positive
Lomandra multiflora subsp. multiflora	3	0.50	0	0.00	positive
Melaleuca decora	5	0.80	4	0.03	positive
Microlaena stipoides var. stipoides	3	1.00	2	0.20	positive
Opercularia diphylla	2	0.60	3	0.01	positive
Ozothamnus diosmifolius	2	0.80	2	0.03	positive
Plantago gaudichaudii	1	0.10	0	0.00	positive
Pratia purpurascens	3	1.00	1	0.12	positive
Pultenaea retusa	2	0.50	2	0.01	positive
Pultenaea villosa	3	0.40	0	0.00	positive
Sporobolus creber	3	0.10	0	0.00	positive
Themeda australis	3	0.80	3	0.08	positive
Tricoryne elatior	1	0.10	0	0.00	positive
Wahlenbergia gracilis	1	0.10	0	0.00	positive
Eustrephus latifolius	2	0.10	2	0.70	negative
Geitonoplesium cymosum	2	0.20	2	0.66	negative
Gymnostachys anceps	0	0.00	2	0.50	negative
Livistona australis	0	0.00	2	0.51	negative
Marsdenia rostrata	1	0.40	2	0.59	negative
Notelaea venosa	1	0.20	3	0.59	negative
Oplismenus imbecillis	4	0.20	3	0.61	negative
Pandorea pandorana subsp. pandorana	1	0.50	2	0.66	negative
Pittosporum undulatum	1	0.50	2	0.64	negative
Pseuderanthemum variabile	1	0.10	3	0.64	negative

MU25 Spotted Gum Open Forest

❑ *DESCRIPTION*



Spotted Gum Open Forest is restricted to a unique patch on east facing hills on Permian shales and siltstones at Mount St. Thomas and Mount Drummond. A tall forest with a dominant canopy of *Corymbia maculata* is present with a mesic shrub layer including *Pittosporum undulatum* and *Notelaea venosa*. Unfortunately, the remnant suffers from intense weed infestation and so numbers of native species are low. Lantana (*Lantana camara*), Bitou Bush (*Chrysanthemoides monilifera* subsp. *rotundata*), Asparagus Fern (*Protasparagus aethiopicus*) and Privet (*Ligustrum* spp.) are all abundant at the site. A ground cover of *Lomandra longifolia, Carex appressa* and *Oplismenus imbecillis* occurs in gaps in the weed layer.

Most of this community within the Wollongong LGA has been cleared. The previous extent of this community was likely to have been highly localised. Remnant Spotted Gum trees in suburban backyards provide an indication of its former distribution. In its current condition this community shares many species with Escarpment Blackbutt Forest. It has been separated for this assessment on the basis of the uniqueness of the canopy species within Wollongong LGA.

With further regional analysis this community may align with vegetation patterns found further south of the LGA. NPWS (2000a) describe an ecosystem known as Northern Foothills Moist Shrub Forest that appears to support a similar assemblage of species in similar habitat in the lower Shoalhaven area.

❑ *FLORISTIC SUMMARY*

Number of Sites: 1

Trees: 20-25m tall. Mean Projected Canopy Cover 50%

Corymbia maculata

Shrubs: 2-4m tall. Mean Projected Canopy Cover 40%

Pittosporum undulatum, Breynia oblongifolia, Rapanea variabilis, Notelaea venosa, Pittosporum revolutum

Ground Covers: 0-1m tall. Mean Projected Canopy Cover 50%

Carex appressa, Lomandra longifolia, Oplismenus imbecillis, Dichondra repens, Pseuderanthemum variabile, Doodia aspera

Vines & Climbers:

Geitonoplesium cymosum, Pandorea pandorana subsp. *pandorana, Marsdenia rostrata, Eustrephus latifolius, Tylophora barbata*

❑ *KEY IDENTIFYING FEATURES*

Easily recognisable features to assist in identifying this map unit are:

- Location in the Mt. St. Thomas, Coniston area.
- Presence of Spotted gum (*Corymbia maculata*).

❑ *EXAMPLE LOCATIONS*

Mt. St. Thomas, Coniston; Mangerton

❑ *CONSERVATION STATUS*

RESERVATION STATUS

Tenure	Study Area (ha)	Proportion of Total (%)	Sydney Basin Bioregion (ha/%)
National Park Estate	0	0	2483 (11)
Water Catchment	0	0	
State Forest	0	0	
Wollongong City Council Reserves	1.68	6.2	
Reserved Subtotal	1.68	6.2	
Other	25.21	93.8	
Total	26.89	100	22706

CONDITION ASSESSMENT

Disturbance Class	Area (ha)	Proportion Extant (%)
A Light	0	0
B Moderate	0	0
C Heavy	11.14	41.1
Scattered trees	15.75	58.6
Total	26.89	100

❑ *THREATENED PLANT SPECIES*

None recorded

❑ *DIAGNOSTIC SPECIES*

Species Name	Group Score	Group Freq	Non Group Score	Non Group Freq	Fidelity Class
Breynia oblongifolia	4	1	1	0.38	positive
Carex appressa	3	1	2	0.09	positive
Corymbia maculata	5	1	2	0.01	positive
Dichondra repens	2	1	3	0.33	positive
Doodia aspera	2	1	3	0.46	positive
Lomandra longifolia	2	1	2	0.45	positive
Pittosporum revolutum	2	1	1	0.39	positive
Poa labillardieri var. labillardieri	2	1	3	0.28	positive
Rapanea variabilis	3	1	2	0.38	positive

MU26 Escarpment Edge Silvertop Ash Forest

❑ *DESCRIPTION*

Escarpment Edge Silvertop Ash Forest is part of a broad complex of forests and woodlands that occur across the Hawkesbury Sandstones of the Woronora Plateau. A moderately tall, open forest comprising *Eucalyptus sieberi, E. piperita* and *Syncarpia glomulifera* subsp. *glomulifera* occurs along the edge of the plateau at the top of the escarpment. The shrub layer includes a mix of sclerophyllous species such as *Persoonia linearis, Telopea speciosissima, Banksia spinulosa* var. *spinulosa* and *Podolobium ilicifolium* in combination with some mesic shrubs such as *Notelaea venosa*, *Synoum glandulosum* subsp. *glandulosum* and *Elaeocarpus reticulatus*. At the summits of Mount Kembla and Mount Keira, *Allocasuarina littoralis* is abundant within this community. The ground cover maintains a profuse cover that includes *Lomandra longifolia* and *Xanthorrhoea resinifera*, ferns such as *Sticherus lobatus* and tangles of *Caustis flexuosa*.

At several locations along the southern end of the escarpment, Escarpment Edge Silvertop Ash Forest grows down the escarpment slope on eroded sandy soils originating from the plateau above. The high rainfall levels that fall on these slopes and on the plateau edge provide sufficient moisture for some hardier mesic species. Consequently, this community shares more similarities with sheltered environments in drier parts of the Woronora Plateau and is not typical of Exposed Hawkesbury Sandstone Woodlands across the catchments. Similar floristic assemblages occur on ridges and exposed slopes in south eastern Royal National Park. Escarpment Edge Silvertop Ash Forest is also likely to share some similarities with Coastal Escarpment Moist Shrub/Fern Forest (Forest Ecosystem 137) in the South Coast Region (NPWS, 2000a).

❑ *FLORISTIC SUMMARY*

Number of Sites: ***3***

Trees: 20-25m tall. Mean Projected Canopy Cover 30%

Eucalyptus sieberi, Eucalyptus piperita, Syncarpia glomulifera subsp. *glomulifera, Corymbia gummifera*

Shrubs: 2-4m tall. Mean Projected Canopy Cover 30%

Allocasuarina littoralis, Persoonia linearis, Persoonia levis, Elaeocarpus reticulatus, Leptospermum rotundifolium, Cassinia trinerva, Platysace lanceolata, Lomatia silaifolia

Ground Covers: 0-1m tall. Mean Projected Canopy Cover 35%

Lomandra longifolia, Caustis flexuosa, Lomandra filiformis var. *filiformis, Patersonia glabrata, Lepidosperma laterale*

❑ *KEY IDENTIFYING FEATURES*

Easily recognisable features to assist in identifying this map unit are:

- Escarpment slopes and plateau edge on sandy soils.
- Moderately tall open forest dominated by Silvertop ash (*Eucalyptus sieberi*), Turpentine *(Syncarpia glomulifera* subsp. *glomulifera)* and Sydney peppermint (*E. piperita*).
- Combinations of typical sandstone shrub species and hardy mesic species occurring in exposed locations.

❑ *EXAMPLE LOCATIONS*

Macquarie Pass National Park; Mount Kembla and Mount Keira Summits

❑ *CONSERVATION STATUS*

RESERVATION STATUS

Tenure	Study Area (ha)	Proportion of Total (%)	Sydney Basin Bioegion (ha/%)
National Park Estate	82.20	13.2	8972 (60)
Water Catchment	261.57	42.1	633 (4)
State Forest	5.73	0.9	
Wollongong City Council Reserves	9.60	1.5	
Reserved Subtotal	359.10	57.9	
Other	273.91	42.1	
Total	633.01	100	14953

CONDITION ASSESSMENT

Disturbance Class	Area (ha)	Proportion Extant (%)
A Light	603.95	97.3
B Moderate	4.69	0.8
C Heavy	4.54	0.7
Scattered trees	7.51	1.2
Total	620.69	100

❑ *THREATENED PLANT SPECIES*

Lomandra brevis (2R)

❑ *DIAGNOSTIC SPECIES*

Species Name	Group Score	Group Freq	Non Group Score	Non Group Freq	Fidelity Class
Acacia terminalis	2	0.33	0	0.00	positive
Allocasuarina littoralis	5	0.67	1	0.03	positive
Amperea xiphoclada var. pedicellata	3	0.67	0	0.00	positive
Billardiera scandens	2	0.67	2	0.11	positive
Cassinia denticulata	1	0.33	0	0.00	positive
Caustis flexuosa	2	0.67	2	0.01	positive
Comesperma ericinum forma A	1	0.33	0	0.00	positive
Cyanicula caerulea	1	0.33	0	0.00	positive
Elaeocarpus reticulatus	4	0.67	1	0.05	positive

Species Name	Group Score	Group Freq	Non Group Score	Non Group Freq	Fidelity Class
Entolasia stricta	3	1.00	3	0.14	positive
Eucalyptus sieberi	5	1.00	4	0.01	positive
Hibbertia aspera subsp. aspera	2	0.67	2	0.02	positive
Hibbertia dentata	2	0.67	2	0.14	positive
Jacksonia scoparia	1	0.33	0	0.00	positive
Lepidosperma filiforme	3	0.33	0	0.00	positive
Leptospermum rotundifolium	2	0.33	0	0.00	positive
Leucopogon lanceolatus var. lanceolatus	2	0.67	2	0.07	positive
Logania albiflora	1	0.33	0	0.00	positive
Lomandra brevis	1	0.33	0	0.00	positive
Lomandra confertifolia subsp. rubiginosa	1	0.33	0	0.00	positive
Lomandra filiformis	2	0.67	0	0.00	positive
Lomandra glauca	4	0.67	2	0.01	positive
Lomandra longifolia	3	0.67	2	0.46	positive
Patersonia glabrata	2	1.00	3	0.01	positive
Persoonia linearis	3	0.67	1	0.04	positive
Platysace lanceolata	3	0.67	1	0.01	positive
Podolobium ilicifolium	2	0.67	2	0.02	positive
Poranthera ericifolia	2	0.33	0	0.00	positive
Pultenaea daphnoides	3	0.33	0	0.00	positive
Pultenaea flexilis	2	0.33	0	0.00	positive
Smilax glyciphylla	3	1.00	2	0.08	positive
Syncarpia glomulifera subsp. glomulifera	4	0.67	4	0.18	positive
Telopea speciosissima	1	0.67	0	0.00	positive
Xanthorrhoea resinifera	4	0.33	0	0.00	positive
Xanthosia pilosa	2	0.67	0	0.00	positive
Xanthosia tridentata	2	0.67	1	0.01	positive
Zieria pilosa	1	0.33	0	0.00	positive
Eustrephus latifolius	0	0.00	2	0.68	negative
Geitonoplesium cymosum	0	0.00	2	0.64	negative
Marsdenia rostrata	1	0.33	2	0.57	negative
Oplismenus imbecillis	0	0.00	3	0.60	negative
Pandorea pandorana subsp. pandorana	1	0.33	2	0.64	negative
Pittosporum undulatum	1	0.33	2	0.63	negative
Pseuderanthemum variabile	0	0.00	3	0.62	negative
Notelaea venosa	2	1.00	3	0.56	constant

MU27 Silvertop Ash Ironstone Woodland

❑ *DESCRIPTION*

Silvertop Ash Ironstone Woodland has previously been described by Keith (1994) as Ironstone Woodland and mapped within the eastern arm of the O'Hares Catchment. Currently available field data does not suggest that the floristic composition of these sites is different to the natural variation found in other sandstone woodlands when compared across the whole Study Area. However, there are a number of conspicuous features of the substrate and floristics composition that are readily identifiable in the field. As a result, the assemblage as defined by Keith (1994) has been mapped outside of O'Hares Catchment using field traverses. Silvertop Ash Ironstone Woodland forms a moderately tall and open forest/woodland that is dominated *by Eucalyptus sieberi*. Occasionally, *Eucalyptus racemosa* or *Corymbia gummifera* mix where the community grades into the adjoining Exposed Sandstone Scribbly Gum Woodland or where soil is skeletal (Map Unit 29). The ground cover provides one the key distinguishing features, the presence of a sparse to dense cover of *Doryanthes excelsa* amongst a low and open shrub layer. Shrub species include *Acacia myrtifolia*, *Daviesia corymbosa*, *Banksia paludosa* subsp. *paludosa*, *Lambertia formosa*, *Hakea dactyloides*, *Persoonia levis* and *Pimelea linifolia* subsp. *linifolia*. Ground covers include *Dampiera stricta*, *Gonocarpus tetragynus* and *Anisopogon avenaceus*.

Silvertop Ash Ironstone Woodland occurs on two forms of ironstone substrate. The first is a deeply weathered mantle of lateritic material that lies above a shallow sandy soil or sandstone bedrock (see photo below). Residual rock may be bound lateritic pebbles akin to toffee brittle or finely shattered ironstone plates. In these locations the floristic composition is more closely aligned to typical sandstone woodlands. The second form is most often found on the margins of shale caps where a weathered red ochre shale soil is present. At these sites the composition of the community leans towards those found in the adjoining O'Hares Creek Shale Forest (Map Unit 17).

The community is restricted to this soil type occurring between the eastern end of the Appin Road and the O'Hares and southern Woronora Catchment. Outside of the Study Area, other lateritic forests are found at Duffy's Forest, Royal National Park and in Ku-ring-gai Chase National Park. However, Smith & Smith (2000) concluded that species composition was sufficiently different between southern and northern forms to warrant the identification of separate communities. The floristic profile for this community is based on that described as Ironstone Woodland (Keith, 1994).

❑ *FLORISTIC SUMMARY*

Number of Sites: ***4***

Trees: 10-15m tall. Mean Projected Canopy Cover 20%

Eucalyptus sieberi, Eucalyptus racemosa, Corymbia gummifera

Shrubs: 0.5-1.5m tall. Mean Projected Canopy Cover 16%

Acacia myrtifolia, Daviesia corymbosa, Banksia paludosa subsp. *paludosa, Persoonia levis, Lambertia formosa, Hakea dactyloides*

Ground covers: 0-1 m tall. Mean Projected Canopy Cover 25%

Doryanthes excelsa, Dampiera stricta, Gonocarpus tetragynus, Patersonia glabrata, Anisopogon avenaceus

1. KEY IDENTIFYING FEATURES

Easily recognisable features to assist in identifying this map unit are:

- A substrate carrying lateritic ironstone fragments, usually above a skeletal sandstone soil.
- High abundance of Silvertop ash (*Eucalyptus sieberi*) that forms a low to moderately tall woodland.
- Presence of a sparse to dense cover of Gymea lily (*Doryanthes excelsa*).

❑ *EXAMPLE LOCATIONS*

Fire Trail 10B, O'Hares Creek Catchment; Appin Road on rise above Loddon Creek; Intersection of Princes Highway and Darkes Forest Road.

❑ *CONSERVATION STATUS*

RESERVATION STATUS

Tenure	Study Area (ha)	Proportion of Total (%)	Sydney Basin Bioegion (ha/%)
National Park Estate	5.88	7.2	988 (68)
Water Catchment	14.71	17.9	314 (22)
State Forest	0	0	
Wollongong City Council Reserves	0	0	
Reserved Subtotal	20.59	25.1	
Other	61.44	74.9	
Total	82.03	100	1453

CONDITION ASSESSMENT

Disturbance Class	Area (ha)	Proportion Extant (%)
A Light	52.03	63.4
B Moderate	16.55	20.2
C Heavy	1.68	2.0
Scattered trees	11.77	14.3
Total	82.03	100

❑ *THREATENED PLANT SPECIES*

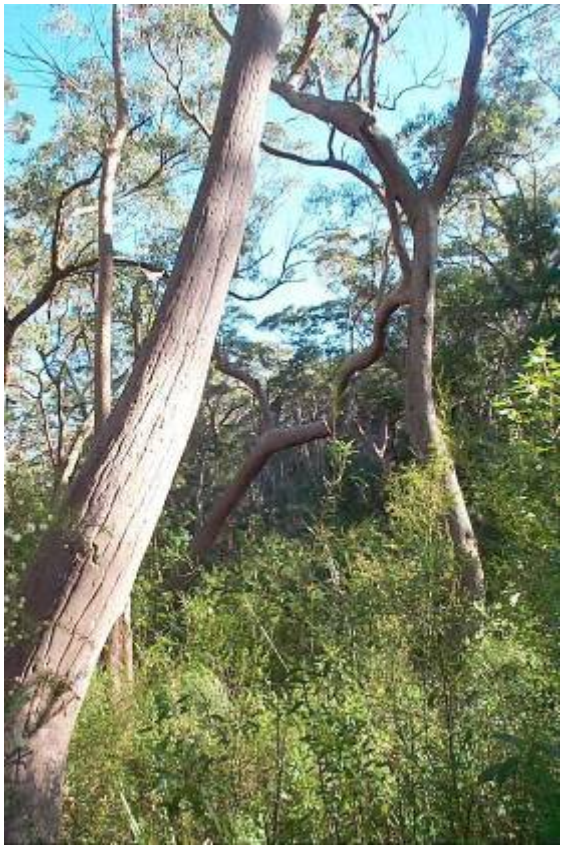
Pultenaea aristata (V), *Darwinia grandiflora* (2R), *Hibbertia nitida* (2R)

❑ *DIAGNOSTIC SPECIES*

No Diagnostic Species List available as classification based on Keith (1994).

MU28 Sandstone Gully Apple-Peppermint Forest

❑ *DESCRIPTION*



Sandstone Gully Apple-Peppermint Forest occurs on sheltered slopes and gullies on the Hawkesbury Sandstones of the nort hern Woronora Plateau. *Angophora costata* and *Eucalyptus piperita* dominate the canopy with *Corymbia gummifera* and *E. sieberi* occurring less freque ntly and at lower abundance. Tall *Banksia serrata* and *Ceratopetalum gummiferum* feature prominently in the shrub/ small tree layer. The shrub layer contains a diverse mix of species including *Banksia spinulosa* var. *spinulosa, Hakea dactyloides, Lambertia formosa, Leptospermum polygalifolium* subsp. *polygalifolium, L. trinervium, Acacia ulicifolia* and *Persoonia pinifolia*. *Doryanthes excelsa* grows amongst the shrub layers when in flower. At other times it occurs amongst other ground covers such as *Lomandra longifolia, Lepidosperma laterale, Pteridium esculentum* and *Caustis flexuosa*.

Sandstone Gully Apple-Peppermint Forest has been previously described and m apped by Keith (1994) as Eastern Gully Forest and (NPWS, 2000c) as Eastern Sandstone Gully Forest. While limited to the north ern section of the Study Area, this community extends west into Dh arawal State Conservation Area, Woronora Catchment and north into Heathcote and Royal National Parks.

❑ *FLORISTIC SUMMARY*

Number of Sites: 33

Trees: 20-25m tall. Mean Projected Cover 50%

Angophora costata, Eucalyptus piperita, Corymbia gummifera, Eucalyptus sieberi and rarely *Eucalyptus agglomerata, Eucalyptus oblonga, Eucalyptus pilularis*

Tall Shrubs: 2-4m tall. Mean Projected Cover 40%

Banksia serrata, Ceratopetalum gummiferum

Shrubs: 1-2m tall. Mean Projected Cover 55%

Hakea dactyloides, Persoonia pinifolia, Leptospermum trinervium, Leptospermum polygalifolium subsp. *polygalifolium, Petrophile pulchella, Banksia ericifolia* subsp. *ericifolia, Grevillea mucronulata, Aotus ericoides*

Ground Covers: 0-1 m tall. Mean Projected Canopy Cover 20%

Lepidosperma laterale, Lomandra longifolia, Caustis flexuosa, Xanthosia pilosa, Gonocarpus teucrioides

❑ *KEY IDENTIFYING FEATURES*

Easily recognisable features to assist in identifying this map unit are:

- Gullies and sheltered slopes of Hawkesbury Sandstone plateau north of the Appin Road.
- Dominance of Smooth-barked apple (*Angophora costata)* and Sydney peppermint (*Eucalyptus piperita)* in the canopy layer.
- A tall shrub layer of Christmas bush *(Ceratopetalum gummiferum*) and *Banksia serrata.*

- A prominent shrub layer of *Banksia spinulosa* var. *spinulosa*, Tea-trees (*Leptospermum* spp.), Gymea lilies (*Doryanthes excelsa*) and *Platysace linearifolia.*

❑ *EXAMPLE LOCATIONS*

Forest Walk; Darkes Forest; Dharawal State Conservation Area; Woronora Catchment.

❑ *CONSERVATION STATUS*

RESERVATION STATUS

Tenure	Study Area (ha)	Proportion of Total (%)	Sydney Basin Bioregion (ha/%)
National Park Estate	69.55	15.0	6800 (51)
Water Catchment	0.41	0.1	2513 (19)
State Forest	0	0	
Wollongong City Council Reserves	1.10	0.2	
Reserved Subtotal	71.06	15.3	
Other	423.84	84.7	
Total	494.90	100	13285

CONDITION ASSESSMENT

Disturbance Class	Area (ha)	Proportion Extant (%)
A Light	368.38	79.2
B Moderate	80.22	17.3
C Heavy	0	0
Scattered trees	16.30	3.5
Total	494.90	100

❑ *THREATENED PLANT SPECIES*

Pultenaea aristata (V), *Grevillea longifolia* (2R)

❑ *DIAGNOSTIC SPECIES*

(Note that Abundance Scores are derived from a 1-6 Braun Blanquet Cover Scale: Diagnostic species have been drawn from sites located on the plateau water catchments only. Some species considered diagnostic for the catchment areas may be common below the escarpment)

Species Name	Group Score	Group Freq	Non Group Score	Non Group Freq	Fidelity Class
Acacia linifolia	2	0.61	2	0.16	positive
Acacia suaveolens	2	0.67	2	0.30	positive
Angophora costata	3	0.91	4	0.06	positive
Aotus ericoides	2	0.64	2	0.10	positive
Banksia cunninghamii subsp. cunninghamii	2	0.06	0	0.00	positive
Banksia ericifolia subsp. ericifolia	2	0.58	3	0.32	positive
Banksia serrata	3	0.91	2	0.31	positive
Banksia spinulosa var. spinulosa	2	0.73	2	0.45	positive
Boronia fraseri	2	0.03	0	0.00	positive
Bossiaea heterophylla	2	0.61	2	0.28	positive
Ceratopetalum gummiferum	2	0.70	2	0.05	positive
Daphnandra species A	1	0.03	0	0.00	positive
Doryanthes excelsa	2	0.70	3	0.05	positive
Entolasia stricta	2	0.58	2	0.48	positive
Epacris longiflora	2	0.61	2	0.03	positive
Eucalyptus piperita	4	0.82	3	0.34	positive
Gahnia aspera	1	0.03	0	0.00	positive

Species Name	Group Score	Group Freq	Non Group Score	Non Group Freq	Fidelity Class
Gahnia radula	1	0.06	0	0.00	positive
Gonocarpus teucrioides	2	0.61	2	0.37	positive
Leptospermum polygalifolium	2	0.58	2	0.14	positive
Lepyrodia scariosa	2	0.64	2	0.37	positive
Liparis reflexa	1	0.03	0	0.00	positive
Lomandra longifolia	2	0.91	2	0.41	positive
Lomandra obliqua	2	0.61	2	0.44	positive
Lomatia silaifolia	2	0.67	2	0.39	positive
Melichrus procumbens	1	0.03	0	0.00	positive
Persoonia pinifolia	2	0.79	2	0.18	positive
Petrophile pulchella	2	0.55	2	0.30	positive
Pimelea linifolia subsp. linifolia	2	0.52	2	0.27	positive
Platysace linearifolia	2	0.82	2	0.36	positive
Pteridium esculentum	2	0.73	2	0.37	positive
Pyrorchis nigricans	1	0.03	0	0.00	positive
Schoenoplectus validus	1	0.03	0	0.00	positive
Smilax glyciphylla	2	0.79	1	0.19	positive
Wahlenbergia gracilis	1	0.03	0	0.00	positive
Xanthosia pilosa	2	0.61	2	0.18	positive
Corymbia gummifera	2	0.70	2	0.53	constant

MU29 Sandstone Gully Peppermint Forest

❑ *DESCRIPTION*

Sandstone Gully Peppermint Forest occupies sheltered slopes and gullies on Hawkesbury Sandstone Plateau south from Bulli Tops. It is a tall dry shrubby forest dominated by *Eucalyptus piperita* and *Corymbia gummifera*, with *E. sieberi* and *E. globoidea* less common. A diverse shrub layer that includes *Banksia spinulosa* var. *spinulosa, Bossiaea obcordata, Persoonia levis, P. linearis, Acacia longifolia* subsp. *longifolia, A. myrtifolia, A. ulicifolia, A. binervata, Pultenaea hispidula* and *Leucopogon lanceolatus* var. *lanceolatus* is present. *Telopea speciosissima* and *Boronia ledifolia* are also common and are conspicuous when in flower. *Banksia serrata* is common as a sparse tall shrub or small tree. The ground cover is similarly diverse with combinations of *Entolasia stricta, Lomandra longifolia, L. obliqua, L. filiformis, Patersonia glabrata, Dianella caerulea, Lomatia silaifolia, Billardiera scandens, Gonocarpus teucrioides* and *Phyllanthus hirtellus* found consistently within sites.

This forest is very closely related to Map Unit 21 Sandstone Gully Apple-Peppermint Forest. The immediate difference is the absence of *Angophora costata* and *Doryanthes excelsa* and the lower abundance and frequency of the tall shrubs *Banksia serrata* and *Ceratopetalum gummiferum*. Sandstone Gully Peppermint Forest is found across the Avon, Cordeaux, Cataract and Nepean Catchments. It extends south into Morton National Park above the Shoalhaven escarpment.

❑ *FLORISTIC SUMMARY*

Number of Sites: 21

Trees: 20-25m tall. Mean Projected Canopy Cover 50%

Eucalyptus piperita, Corymbia gummifera, Eucalyptus sieberi, Eucalyptus globoidea

Shrubs: 2-4m tall. Mean Projected Canopy Cover 40%

Banksia spinulosa var. *spinulosa, Acacia terminalis, Acacia ulicifolia, Persoonia linearis, Persoonia levis, Leptospermum polygalifolium* subsp. *polygalifolium, Leucopogon lanceolatus* var. *lanceolatus, Telopea speciosissima*

Ground Covers: 0-1 m tall. Mean Projected Canopy Cover 20%

Lepidosperma laterale, Lomandra longifolia, Caustis flexuosa, Xanthosia pilosa, Gonocarpus teucrioides

❑ *KEY IDENTIFYING FEATURES*

Easily recognisable features to assist in identifying this map unit are:

- Gullies and sheltered slopes of Hawkesbury Sandstone plateau south of the Appin Road, Bulli Tops.
- Dominance of Sydney peppermint (*Eucalyptus piperita*) and Red bloodwood (*Corymbia gummifera*) in the canopy layer.

- A dense sandstone shrub layer characterised by *Banksia spinulosa* var. *spinulosa* and *Leucopogon lanceolatus* var. *lanceolatus*.
- Abundant Bracken (*Pteridium esculentum*).

❑ *EXAMPLE LOCATIONS*

Avon, Cordeaux and Cataract Catchments

❑ *CONSERVATION STATUS*

RESERVATION STATUS

Tenure	Study Area (ha)	Proportion of Total (%)	Sydney Basin Bioregion (ha/%)
National Park Estate	1.17	0.2	9310 (38)
Water Catchment	348.71	74.2	10003 (41)
State Forest	70.96	15.1	
Wollongong City Council Reserves	0	0	
Reserved Subtotal	420.84	89.5	
Other	48.91	10.4	
Total	469.75	100	24500

CONDITION ASSESSMENT

Disturbance Class	Area (ha)	Proportion Extant (%)
A Light	468.68	99.8
B Moderate	1.07	0.2
C Heavy	0	0
Scattered trees	0	0
Total	469.75	100

❑ *THREATENED PLANT SPECIES*

None recorded

❑ *DIAGNOSTIC SPECIES*

(Note that Abundance Scores are derived from a 1-6 Braun Blanquet Cover Scale: Diagnostic species have been drawn from sites located on the plateau water catchments only. Some species considered diagnostic for the catchment areas may be common below the escarpment)

Species Name	Group Score	Group Freq	Non Group Score	Non Group Freq	Fidelity Class
Acacia longissima	1	0.03	0	0.00	positive
Amyema pendulum subsp. pendulum	2	0.03	0	0.00	positive
Banksia spinulosa var. spinulosa	2	0.71	2	0.45	positive
Billardiera scandens	2	0.58	2	0.26	positive
Bossiaea buxifolia	2	0.03	0	0.00	positive
Dianella caerulea	2	0.81	2	0.27	positive
Dipodium variegatum	1	0.03	0	0.00	positive
Entolasia stricta	2	0.61	2	0.48	positive
Eucalyptus piperita	3	0.94	3	0.33	positive
Gonocarpus teucrioides	2	0.71	2	0.37	positive
Helichrysum calvertianum	1	0.03	0	0.00	positive
Hovea longifolia	1	0.03	0	0.00	positive
Lepidosperma elatius	2	0.03	0	0.00	positive
Leucopogon lanceolatus var. lanceolatus	2	0.61	2	0.19	positive
Lomandra longifolia	2	0.94	2	0.41	positive

Species Name	Group Score	Group Freq	Non Group Score	Non Group Freq	Fidelity Class
Lomandra obliqua	2	0.58	2	0.45	positive
Lomatia silaifolia	2	0.68	2	0.40	positive
Persoonia levis	2	0.58	1	0.47	positive
Polyscias sambucifolia	1	0.03	0	0.00	positive
Pteridium esculentum	2	0.94	2	0.35	positive
Pultenaea villifera var. villifera	2	0.03	0	0.00	positive
Schelhammera undulata	1	0.03	0	0.00	positive
Smilax glyciphylla	2	0.58	1	0.22	positive
Symphionema montanum	1	0.03	0	0.00	positive
Wahlenbergia stricta subsp. stricta	2	0.06	0	0.00	positive
Corymbia gummifera	2	0.61	2	0.53	constant

MU30 Exposed Sandstone Scribbly Gum Woodland

❑ *DESCRIPTION*

The ridges and exposed slopes across the Hawkesbury Sandstones of the Woronora Plateau support a low open woodland complex. A combination of different Scribbly gums (*Eucalyptus sclerophylla, E. racemosa, E. haemastoma* and hybrids between each) occurs with *E. oblonga, Corymbia gummifera, E. sieberi* and *E. piperita*. *Angophora costata* occurs within this complex north from Bulli Tops. The density of the shrub layer is variable depending on fire history. Species present can include *Banksia spinulosa* var. *spinulosa*, *Leptospermum trinervium, Isopogon anemonifolius, Acacia ulicifolia, Hakea dactyloides, Eriostemon australasius* and *Bossiaea heterophylla*. The ground cover is not dense, with species such as *Lomandra glauca, Entolasia stricta*, small shrubs including *Dampiera stricta* and tangles of *Caustis flexuosa* frequently encountered.

Skeletal sandy soils of low fertility lie underneath this vegetation community. On exposed slopes the ground is often rocky, with large boulders outcropping on ridgetop peaks and on slope benches. These environments have been previously described and mapped by Benson & Howell (1995) as Exposed Sandstone Woodland, Keith (1994) as Sandstone Woodland and by NPWS (2000c) as Sandstone Ridgetop Woodland. NPWS (2000a) define a closely aligned assemblage occurring on sandstone ridges in Morton National Park (Forest Ecosystem 139: Northern Coastal Hinterland Heath Shrub Dry Forest).

❑ *FLORISTIC SUMMARY*

Number of Sites: ***82***

Trees: 10-15m tall. Mean Projected Canopy Cover 15%

Eucalyptus sclerophylla, Eucalyptus racemosa, Eucalyptus haemastoma, Corymbia gummifera, Eucalyptus oblonga, Eucalyptus sieberi, Eucalyptus piperita, Angophora costata

Shrubs: 2-8m tall. Mean Projected Canopy Cover 35%

Banksia spinulosa var. *spinulosa, Leptospermum trinervium, Platysace linearifolia, Dillwynia retorta, Petrophile sessilis, Eriostemon australasius, Isopogon anemonifolius, Phyllanthus hirtellus, Lambertia formosa, Hakea sericea, Persoonia levis*

Ground Covers: 0-1 m tall. Mean Projected Canopy Cover 20%

Entolasia stricta, Lomandra obliqua, Cyathochaeta diandra, Lepyrodia scariosa, Dampiera stricta, Lepidosperma laterale

❑ *KEY IDENTIFYING FEATURES*

Easily recognisable features to assist in identifying this map unit are:

- Exposed slopes and ridgetops on sandstone plateau above escarpment.
- A low heathy woodland dominated by Scribbly gums (*Eucalyptus sclerophylla, E. racemosa*) with Red bloodwood (*Corymbia gummifera*), Narrow-leaved stringybark (*Eucalyptus oblonga*) and Silvertop ash (*E. sieberi*).
- A diverse heath understorey marked by *Banksia* spp*.,* Tea-tree (*Leptospermum trinervium*) and Broad-leaved hakea (*Hakea dactyloides*)*.*

❑ *EXAMPLE LOCATIONS*

Dharawal State Conservation Area; Bulli Tops

❑ *CONSERVATION STATUS*

RESERVATION STATUS

Tenure	Study Area (ha)	Proportion of Total (%)	Sydney Basin Bioregion (ha/%)
National Park Estate	69.61	4.5	3255 (9)
Water Catchment	533.14	34.4	32916 (90)
State Forest	8.53	0.5	9 (0.02)
Wollongong City Council Reserves	3.48	0.2	
Reserved Subtotal	614.76	39.6	
Other	936.65	60.4	
Total	1551.41	100	37022

CONDITION ASSESSMENT

Disturbance Class	Area (ha)	Proportion Extant (%)
A Light	1278.16	82.4
B Moderate	201.09	13.0
C Heavy	24.22	1.6
Scattered trees	47.94	3.1
Total	1551.41	100

❑ *THREATENED PLANT SPECIES*

Pomaderris adnata (E1), *Pultenaea aristata* (V), *Darwinia grandiflora* (3R), *Darwinia diminuta* (3R)

❑ *DIAGNOSTIC SPECIES*

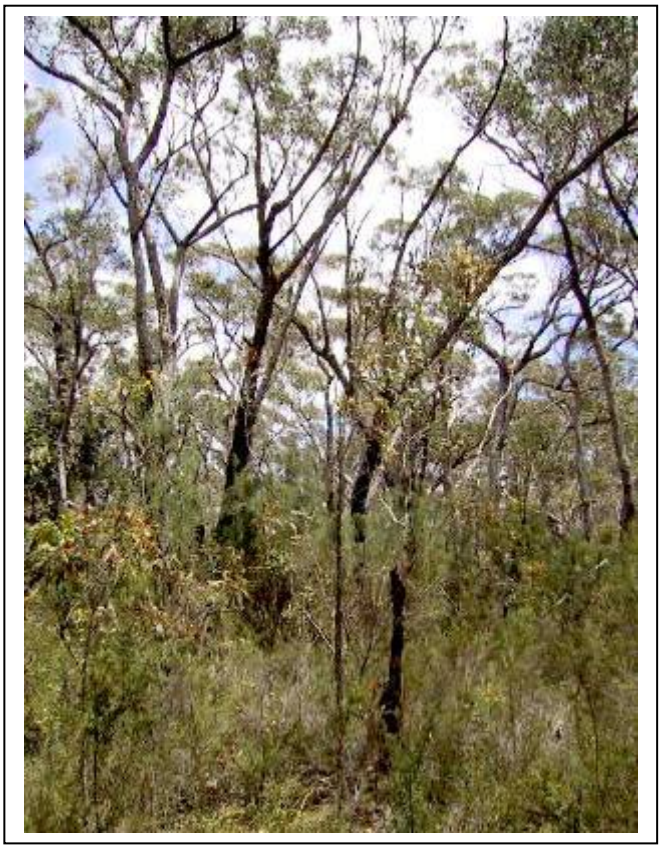
(Note that Abundance Scores are derived from a 1-6 Braun Blanquet Cover Scale: Diagnostic species have been drawn from sites located on the plateau water catchments only. Some species considered diagnostic for the catchment areas may be common below the escarpment)

Species Name	Group Score	Group Freq	Non Group Score	Non Group Freq	Fidelity Class
Acacia myrtifolia	2	0.72	2	0.15	positive
Acacia suaveolens	2	0.76	2	0.26	positive
Acacia ulicifolia	2	0.52	1	0.20	positive
Actinotus minor	2	0.62	2	0.24	positive
Banksia ericifolia subsp. ericifolia	2	0.59	3	0.30	positive
Banksia serrata	2	0.76	2	0.30	positive
Banksia spinulosa var. spinulosa	2	0.66	2	0.44	positive
Boronia anethifolia	1	0.02	0	0.00	positive

Species Name	Group Score	Group Freq	Non Group Score	Non Group Freq	Fidelity Class
Bossiaea heterophylla	2	0.79	2	0.23	positive
Bossiaea obcordata	2	0.50	2	0.13	positive
Caustis flexuosa	2	0.57	2	0.20	positive
Choretrum species A	1	0.02	0	0.00	positive
Corymbia gummifera	2	0.91	2	0.48	positive
Cryptostylis leptochila	1	0.02	0	0.00	positive
Cyathochaeta diandra	2	0.55	2	0.28	positive
Dampiera stricta	2	0.71	2	0.33	positive
Darwinia biflora	2	0.05	0	0.00	positive
Dichelachne micrantha	1	0.02	0	0.00	positive
Entolasia stricta	2	0.53	2	0.48	positive
Epacris crassifolia	2	0.02	0	0.00	positive
Eucalyptus racemosa	2	0.53	2	0.17	positive
Eucalyptus sieberi	2	0.71	2	0.21	positive
Eucalyptus sparsifolia	3	0.02	0	0.00	positive
Gompholobium pinnatum	1	0.02	0	0.00	positive
Grevillea triternata	2	0.07	0	0.00	positive
Hakea dactyloides	2	0.88	2	0.33	positive
Hibbertia virgata subsp. virgata	1	0.02	0	0.00	positive
Isopogon anemonifolius	2	0.93	2	0.30	positive
Lambertia formosa	2	0.90	2	0.30	positive
Laxmannia compacta	1	0.02	0	0.00	positive
Leptospermum trinervium	2	0.97	2	0.37	positive
Lepyrodia scariosa	2	0.69	2	0.34	positive
Lomandra confertifolia subsp. pallida	2	0.02	0	0.00	positive
Lomandra obliqua	2	0.84	2	0.39	positive
Lomatia silaifolia	2	0.66	2	0.38	positive
Monotoca scoparia	2	0.64	1	0.24	positive
Ophioglossum lusitanicum	1	0.02	0	0.00	positive
Patersonia glabrata	2	0.55	2	0.22	positive
Persoonia levis	2	0.86	1	0.42	positive
Persoonia oblongata	3	0.02	0	0.00	positive
Petrophile canescens	2	0.02	0	0.00	positive
Petrophile pulchella	2	0.52	2	0.29	positive
Phyllota grandiflora	1	0.02	0	0.00	positive
Pimelea linifolia subsp. linifolia	2	0.57	2	0.24	positive
Platysace linearifolia	2	0.72	2	0.34	positive
Plinthanthesis paradoxa	1	0.02	0	0.00	positive
Sphaerolobium minus	1	0.02	0	0.00	positive

MU31 Nepean Enriched Sandstone Woodland

❑ *DESCRIPTION*



Nepean Enriched Sandstone Woodland is a moderately tall forest-woodland occurring on enriched sandstone ridges at higher elevations in the Nepean Catchment. *Corymbia gummifera* and *Eucalyptus globoidea/oblonga* occur consistently in the canopy. Other associate tree species are less regularly observed. These include *Eucalyptus sieberi*, *E. piperita, E. racemosa/ sclerophylla* and *E. punctata*. The shrub layers comprise species that are common to other sandstone ridgetops such as *Banksia spinulosa* var. *spinulosa*, *Lambertia formosa*, *Petrophile pulchella*, *Hakea dactyloides* and *Leptospermum trinervium*. The diversity of the shrub layer is decreased, with *Acacia terminalis* the prominent wattle and many of the *Banksia* species occurring to the north east no longer present in this community. The ground cover is a mixture of *Cyathochaeta diandra*, *Entolasia stricta*, *E. marginata*, *Lomandra obliqua* and *L. filiformis* var. *filiformis* amongst small shrubs of *Phyllanthus hirtellus* and *Goodenia heterophylla*. A number of species appear unique to this community including the small shrubs *Epacris calvertiana* var. *calvertiana, Cryptandra propinqua* and *Daviesia acicularis* and the ground cover *Mirbelia platylobioides*. These are likely to reflect the higher elevations and cooler climates of the western edge of the catchment. Sites describing this community are generally situated above 450 metres in elevation.

In the Nepean Catchment, Sandstones from the Mittagong Formation dominate the substrate along many of the wide ridges that extend toward Avon and Cordeaux Catchments. The Mittagong Formation alternates bands of Shale and fine grained sandstone (Herbert *et al*. 1980). These sandstones are also likely to provide a slightly more fertile soil along the western area of the Metropolitan Catchment. Hence, the appearance of the forest is generally taller with a less heathy understorey than those on soils of Hawkesbury Sandstone.

❑ *FLORISTIC SUMMARY*

Number of Sites: 27

Trees: 25-35m tall. Mean Projected Canopy Cover 45%

Corymbia gummifera, Eucalyptus globoidea, Eucalyptus oblonga, (including hybrids)*, Eucalyptus eugenioides, Eucalyptus piperita, Eucalyptus sieberi, Eucalyptus punctata* (in localised patches only)

Shrubs: 2-8m tall. Mean Projected Canopy Cover 35%

Banksia spinulosa var. *spinulosa, Persoonia levis, Lomatia silaifolia, Leptospermum trinervium, Acacia terminalis, Acacia myrtifolia, Acacia longifolia* subsp. *longifolia, Hakea dactyloides, Petrophile pulchella, Pimelea linifolia* subsp. *linifolia, Lambertia formosa, Hibbertia aspera*

Ground covers: 0-1 m tall. Mean Projected Canopy Cover 20%

Cyathochaeta diandra, Patersonia sericea, Entolasia stricta, Entolasia marginata, Lomandra obliqua, Lomandra filiformis var. *filiformis, Dianella longifolia, Phyllanthus hirtellus*

❑ *KEY IDENTIFYING FEATURES*

Easily recognisable features to assist in identifying this map unit are:

- Located primarily within the Nepean Catchment on broad Sandstone ridges and exposed slopes at elevations greater than 450 metres.
- The colour of the underlying soil tends to be red-orange and rock outcrops are infrequent to absent.
- The forest canopy has Red bloodwood (*Corymbia gummifera*) and White stringybark (*Eucalyptus globoidea*) as a common thread. Several other tree species co-occur including Scribbly gum (*E. racemosa*), Silvertop ash (*E. sieberi*) and Sydney peppermint (*E. piperita*). At times the community may be dominated by White stringybark and Red bloodwood alone, indicating a slightly stronger shale influence in the soil.
- The shrub understorey has a slightly different visual appearance to other exposed sandstone vegetation. *Banksia serrata* is not present in this assemblage, while elsewhere it is conspicuous. Sunshine wattle (*Acacia terminalis*) is more commonly recorded in this community.
- the ground cover tends to be grassy with a dominance of *Entolasia marginata*, *E. stricta* and *Austrostipa pubescens*.

❑ *EXAMPLE LOCATIONS*

Fire Trail 1A, Nepean Catchment

❑ *CONSERVATION STATUS*

RESERVATION STATUS

Tenure	Study Area (ha)	Proportion of Total (%)	Sydney Basin Bioregion (ha/%)
National Park Estate	0	0	0 (0)
Water Catchment	17.89	100	5291 (100)
State Forest	0	0	
Wollongong City Council Reserves	0	0	
Reserved Subtotal	0	0	
Other	0	0	
Total	17.89	100	>5291

CONDITION ASSESSMENT

Disturbance Class	Area (ha)	Proportion Extant (%)
A Light	17.89	100
B Moderate	0	0
C Heavy	0	0
Scattered trees	0	0
Total	17.89	100

❑ *THREATENED PLANT SPECIES*

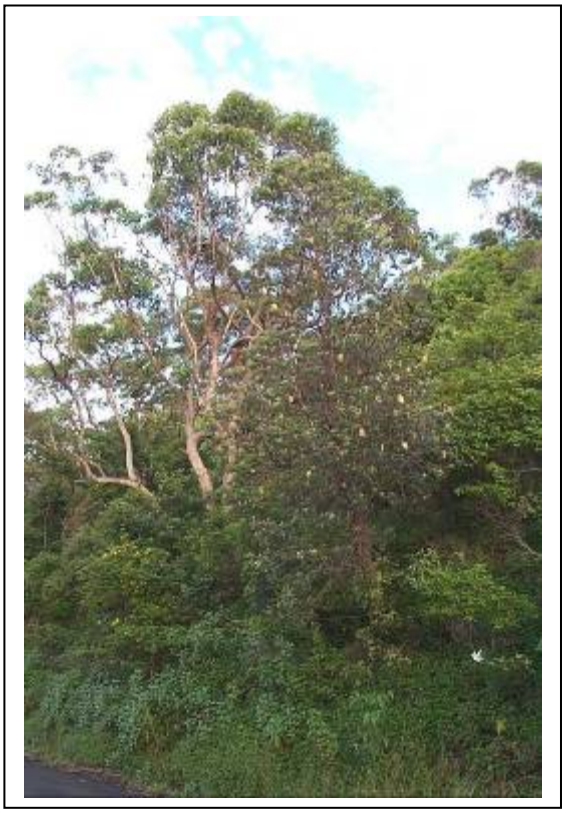
Hibbertia nitida (2R), *Lissanthe sapida* (3R)

❑ *DIAGNOSTIC SPECIES*

Species Name	Group Score	Group Freq	Non Group Score	Non Group Freq	Fidelity Class
Austrostipa pubescens	2	0.59	2	0.13	positive
Austrostipa verticillata	1	0.11	0	0.00	positive
Banksia spinulosa var. spinulosa	2	1.00	2	0.42	positive
Billardiera scandens	2	0.56	1	0.27	positive
Bossiaea obcordata	2	0.89	2	0.10	positive
Corymbia gummifera	2	0.89	2	0.50	positive
Cryptandra propinqua	2	0.04	0	0.00	positive
Cryptandra spinescens	2	0.04	0	0.00	positive
Cyathochaeta diandra	2	0.85	2	0.30	positive
Daviesia acicularis	1	0.04	0	0.00	positive
Dianella longifolia	2	0.56	2	0.05	positive
Epacris calvertiana var. calvertiana	1	0.04	0	0.00	positive
Eucalyptus racemosa	2	0.70	2	0.28	positive
Eucalyptus sieberi	2	0.59	2	0.23	positive
Euchiton sphaericus	1	0.04	0	0.00	positive
Goodenia bellidifolia subsp. bellidifolia	2	0.59	2	0.12	positive
Goodenia hederacea subsp. hederacea	2	0.63	2	0.09	positive
Grevillea phylicoides	1	0.04	0	0.00	positive
Hibbertia aspera subsp. aspera	2	0.56	2	0.11	positive
Lambertia formosa	2	0.56	2	0.37	positive
Leptospermum trinervium	2	0.67	2	0.47	positive
Lomandra filiformis subsp. filiformis	2	0.67	2	0.17	positive
Lomandra obliqua	2	0.78	2	0.43	positive
Lomatia silaifolia	2	0.89	1	0.38	positive
Mirbelia platylobioides	1	0.11	0	0.00	positive
Patersonia sericea	2	0.78	1	0.24	positive
Persoonia levis	2	0.81	1	0.46	positive
Petrophile pulchella	2	0.59	2	0.29	positive
Phyllanthus hirtellus	2	0.67	2	0.20	positive
Pimelea glauca	2	0.04	0	0.00	positive
Pimelea linifolia subsp. linifolia	2	0.59	2	0.19	positive
Tetratheca thymifolia	2	0.63	1	0.02	positive
Entolasia stricta	2	0.81	2	0.52	constant

MU32 Exposed Bangalay-Banksia Woodland

❑ *DESCRIPTION*



Exposed Bangalay-Banksia Woodland occurs on exposed steep hillslopes north of Austinmer where the escarpment and foothills come in close proximity to the oce an. This community ranges from a stunted windblown woodland to an open forest. Gen erally, there is an increase in the height of vegetation (ranging between eight to twenty metres) with increasing shelter from ocean win ds. The canopy is dominated by *Eucalyptus botryoides, Syncarpia glomulifera* subsp. *glomulifera* and *Banksia integrifolia* subsp. *integrifolia*. The understorey commonly comprises *Tristaniopsis collina, Glochidion ferdinandi, Livistona australis, Rapanea variabilis, Pittosporum undulatum* and *Acmena smithii*. Ground cover species include *Lomandra longifolia, Pteridium esculentum, Poa labillardieri* var. *labillardieri, Dichondra repens* and *Imperata cylindrica* var. *major*.

Exposed Bangalay-Banksia Woodland forms pa rt of a larger complex influenced by maritime climates and clay soils. Most locatio ns are less than 300 metres from the ocean on so uth easterly aspects. On the steep exposed escarpment slopes, such as tho se at northern Stanwell Park and Coalcliff, this community continues almost to the top of the slope at el evations around 250 m etres. Transition and grades are frequent b etween the si milar Littoral Map Units of Littoral Wind shear Thicket and Coastal Headland Banksia Scrub.

This community extends i nto Royal National Park on headlands and escarpment slopes behind Werrong, Burning Palms, Era and G arie. Similar vegetation occurr ing on clay soils is no t described by either NPW S (2000a) or Mills (2000) to the so uth of the Woll ongong LGA. An equivalent ve getation community has also not been described for the area between Gosford and Newcastle (NPWS, 2000b).

❑ *FLORISTIC SUMMARY*

Number of sites: 4

Small Trees-Tall Shrubs: 5-15m tall. Mean Projected Canopy Cover 50%

Eucalyptus botryoides, Banksia integrifolia subsp. *integrifolia, Syncarpia glomulifera* subsp. *glomulifera*

Shrubs: 1-6m tall. Mean Projected Canopy Cover 25%

Breynia oblongifolia, Leucopogon lanceolatus var. *lanceolatus, Tristaniopsis collina, Pittosporum undulatum, Rapanea variabilis, Synoum glandulosum* subsp. *glandulosum* and less commonly *Syncarpia glomulifera* subsp. *glomulifera, Acmena smithii, Cryptocarya microneura*

Ground Covers: 0-1 m tall. Mean Projected Canopy Cover 60%

Lomandra longifolia, Hibbertia scandens, Pteridium esculentum, Poa labillardieri var. *labillardieri, Commelina cyanea, Dianella caerulea, Oplismenus imbecillis, Imperata cylindrica* var. *major, Dichondra repens, Hibbertia dentata, Doodia aspera, Schelhammera undulata*

Vines & Climbers:

Eustrephus latifolius, Glycine clandestina, Kennedia rubicunda, Geitonoplesium cymosum, Billardiera scandens var. *scandens*

❑ *KEY IDENTIFYING FEATURES*

Easily recognisable features to assist in identifying this map unit are:

- Location on hillslopes directly facing or in close proximity to the ocean.
- An often low woodland canopy dominated by Bangalay (*Eucalyptus botryoides*) and Coast banksia (*Banksia integrifolia* subsp. *integrifolia*).
- A subcanopy comprising Mountain water gum (*Tristaniopsis collina*), Sweet pittosporum (*Pittosporum undulatum*) and Muttonwood (*Rapanea variabilis*).
- A dense grassy ground layer dominated by Spiny-headed mat-rush (*Lomandra longifolia*), Tussock (*Poa labillardieri* var. *labillardieri*), Blady grass (*Imperata cylindrica*) with occasional herbs and ferns such as Rasp fern (*Doodia aspera*) and Lilac lily (*Schelhammera undulata*).

❑ *EXAMPLE LOCATIONS*

Escarpment slope between Coalcliff and Stanwell Park; Clifton; Coledale Hospital, Scarborough.

❑ *CONSERVATION STATUS*

RESERVATION STATUS

Tenure	Study Area (ha)	Proportion of Total (%)	Sydney Basin Bioregion (ha/%)
National Park Estate	17.38	11.7	606 (82)
Water Catchment	0	0	
State Forest	0	0	
Wollongong City Council Reserves	10.26	6.9	
Reserved Subtotal	27.64	18.6	
Other	120.66	81.4	
Total	148.30	100	737

CONDITION ASSESSMENT

Disturbance Class	Area (ha)	Proportion Extant (%)
A Light	34.97	23.6
B Moderate	41.81	28.2
C Heavy	60.30	40.7
Scattered trees	11.22	7.6
Total	148.30	100

❑ *THREATENED PLANT SPECIES*

None recorded

❑ *DIAGNOSTIC SPECIES*

Species Name	Group Score	Group Freq	Non Group Score	Non Group Freq	Fidelity Class
Acacia maidenii	2	0.50	1	0.39	positive
Adiantum aethiopicum	3	0.50	2	0.10	positive
Angophora costata	1	0.25	0	0.00	positive
Banksia integrifolia subsp. integrifolia	4	1.00	4	0.06	positive
Billardiera scandens	2	0.50	2	0.11	positive
Breynia oblongifolia	2	0.50	2	0.39	positive
Dianella caerulea	2	0.75	1	0.25	positive
Dichondra repens	2	0.75	3	0.33	positive
Doodia aspera	3	0.50	3	0.45	positive

Species Name	Group Score	Group Freq	Non Group Score	Non Group Freq	Fidelity Class
Doryanthes excelsa	4	0.25	0	0.00	positive
Eucalyptus botryoides	5	1.00	4	0.13	positive
Gahnia melanocarpa	2	0.50	2	0.11	positive
Glochidion ferdinandi	2	0.50	1	0.12	positive
Glycine clandestina	2	0.75	2	0.24	positive
Hibbertia dentata	2	0.75	2	0.14	positive
Hydrocotyle laxiflora	3	0.50	2	0.04	positive
Imperata cylindrica var. major	4	0.75	2	0.14	positive
Leucopogon juniperinus	2	0.50	3	0.05	positive
Leucopogon lanceolatus var. lanceolatus	4	0.50	2	0.07	positive
Livistona australis	2	0.75	2	0.48	positive
Lomandra longifolia	3	1.00	2	0.45	positive
Plectranthus parviflorus	2	0.50	2	0.19	positive
Poa labillardieri var. labillardieri	3	1.00	3	0.27	positive
Pteridium esculentum	2	1.00	2	0.17	positive
Rapanea variabilis	4	0.75	2	0.37	positive
Schelhammera undulata	3	0.50	2	0.05	positive
Smilax glyciphylla	3	0.50	2	0.09	positive
Syncarpia glomulifera subsp. glomulifera	5	0.50	4	0.18	positive
Synoum glandulosum subsp. glandulosum	2	0.75	2	0.39	positive
Tristaniopsis collina	3	0.75	3	0.06	positive
Marsdenia rostrata	1	0.25	2	0.57	negative
Notelaea venosa	0	0.00	3	0.58	negative
Pandorea pandorana subsp. pandorana	0	0.00	2	0.65	negative
Pseuderanthemum variabile	1	0.25	3	0.62	negative
Eustrephus latifolius	2	0.75	2	0.66	constant
Geitonoplesium cymosum	2	0.75	2	0.63	constant
Oplismenus imbecillis	2	0.75	3	0.58	constant
Pittosporum undulatum	3	0.75	2	0.63	constant

MU33 Coastal Sand Bangalay-Blackbutt Forest

❑ *DESCRIPTION*

Coastal Sand Bangalay-Blackbutt Forest is a low open forest occurring on the gentle slopes and crests of large sand dunal systems. Dunes that rise above 10 metres in elevation support a vegetation community dominated by *Eucalyptus botryoides* often with *E. pilularis* and *Corymbia gummifera* as co-dominant canopy species. *Banksia serrata, B. integrifolia* subsp. *integrifolia, Endiandra sieberi, Leptospermum laevigatum, Monotoca elliptica* and *Acacia longifolia* subsp. *sophorae* form a moderately dense shrub layer. The ground layer is typically a combination of *Pteridium esculentum* and *Lomandra longifolia*.

The Windang and Primbee sand mass support the largest remnant patches of Coastal Sand Bangalay-Blackbutt Forest in the Wollongong LGA. However, much of the sand mass here has been extensively disturbed by sand mining and clearing. Invasive weed species Bitou bush (*Chrysanthemoides monilifera* subsp. *rotundata*) and *Lantana camara* are widespread within this community. Low numbers of native species recorded at these sites are likely to reflect the impact of disturbance and weed infestation.

Similar vegetation communities appear to extend along the south coast where large sandmasses are present. Mills (2000) describes a similar community at Minnamurra Spit in the Shellharbour LGA while NPWS (2000a) refer to a closely related Forest Ecosystem (Coastal Sands Shrub/Fern Forest) which covers sand complexes at Jervis Bay, Clyde and Moruya.

❑ *FLORISTIC SUMMARY*

Number of sites: ***3***

Trees: 8-22m tall. Mean Projected Canopy Cover 38%

Eucalyptus botryoides, Eucalyptus pilularis, Corymbia gummifera

Shrubs: 1-6m tall. Mean Projected Canopy Cover 47%

Banksia serrata, Banksia integrifolia subsp. *integrifolia, Acacia longifolia* subsp. *sophorae, Breynia oblongifolia, Leptospermum laevigatum, Monotoca elliptica, Pittosporum revolutum, Dodonaea triquetra*

Ground Covers: 0-1 m tall. Mean Projected Canopy Cover 35%

Lomandra longifolia, Pteridium esculentum, Commelina cyanea, Imperata cylindrica var. *major, Dianella longifolia, Dianella caerulea, Desmodium brachypodum, Plectranthus parviflorus*

Vines & Climbers:

Billardiera scandens var. *scandens, Cassytha pubescens, Clematis glycinoides* var. *glycinoides*

❑ *KEY IDENTIFYING FEATURES*

Easily recognisable features to assist in identifying this map unit are:

- Location on coastal sands and sand dunes
- A low open forest structure the canopy comprising mainly Bangalay (*Eucalyptus botryoides*). At Windang, Blackbutt (*E. pilularis*) and Red bloodwood (*Corymbia gummifera*) are co-dominant.
- Shrubs and small trees common to sandy soils such as Coast tea-tree (*Leptospermum laevigatum*), Sydney golden wattle (*Acacia longifolia* subsp. *sophorae*), Saw banksia (*Banksia serrata*) and *Breynia oblongifolia,* Wedding bush (*Ricinocarpos pinifolius*) and Broom heath (*Monotoca elliptica*).
- High abundances of the weed Bitou bush (*Chrysanthemoides monilifera* subsp. *rotundata*).
- A ground layer including species common to sandy soils including some of the following; Spiny-headed mat-rush (*Lomandra longifolia*), Bracken (*Pteridium esculentum*), Scurvy weed (*Commelina cyanea*) and Blady grass (*Imperata cylindrica* var. *major*).

❑ *EXAMPLE LOCATIONS*

Puckeys Estate; Bellambi Lagoon; Primbee-Windang area.

❑ *CONSERVATION STATUS*

RESERVATION STATUS

Tenure	Study Area (ha)	Proportion of Total (%)	Sydney Basin Bioregion (ha/%)
National Park Estate	0	0	1244 (39)
Water Catchment	0	0	
State Forest	0	0	
Wollongong City Council Reserves	21.09	74.1	
Reserved Subtotal	21.09	74.1	
Other	7.36	25.9	
Total	28.45	100	3181

CONDITION ASSESSMENT

Disturbance Class	Area (ha)	Proportion Extant (%)
A Light	3.06	10.8
B Moderate	17.04	59.9
C Heavy	5.99	21.1
Scattered trees	2.36	8.3
Total	28.45	100

❑ *THREATENED PLANT SPECIES*

None recorded

❑ *DIAGNOSTIC SPECIES*

Species Name	Group Score	Group Freq	Non Group Score	Non Group Freq	Fidelity Class
Banksia serrata	2	1.00	2	0.02	Positive
Billardiera scandens	2	1.00	2	0.09	Positive
Breynia oblongifolia	4	1.00	1	0.38	Positive
Cassytha pubescens	2	1.00	2	0.03	Positive
Commelina cyanea	3	1.00	2	0.32	positive
Desmodium brachypodum	1	0.33	0	0.00	positive
Desmodium varians	2	0.67	2	0.18	positive
Dianella crinoides	3	0.67	0	0.00	positive
Dodonaea triquetra	1	0.33	0	0.00	positive
Duboisia myoporoides	4	0.67	2	0.01	positive
Endiandra sieberi	4	0.67	4	0.02	positive
Eucalyptus botryoides	5	0.67	4	0.14	positive
Glycine species A	3	0.33	0	0.00	positive
Hardenbergia violacea	3	0.67	2	0.05	positive
Imperata cylindrica var. major	3	0.67	2	0.14	positive
Leptospermum laevigatum	4	0.67	5	0.03	positive
Lomandra longifolia	4	1.00	2	0.45	positive
Pittosporum revolutum	4	0.67	1	0.39	positive
Plantago debilis	2	0.33	0	0.00	positive
Pteridium esculentum	4	1.00	2	0.15	positive
Ricinocarpos pinifolius	2	0.67	0	0.00	positive
Eustrephus latifolius	0	0.00	2	0.68	negative
Notelaea venosa	4	0.33	3	0.58	negative
Oplismenus imbecillis	4	0.33	3	0.59	negative
Pandorea pandorana subsp. pandorana	0	0.00	2	0.66	negative
Pittosporum undulatum	1	0.33	2	0.64	negative
Pseuderanthemum variabile	0	0.00	3	0.62	negative

MU34 Coastal Sand Swamp Mahogany Forest

❑ *DESCRIPTION*

At Port Kembla Golf Course an open forest comprising a dominant canopy *of Eucalyptus robusta* occurs above a cover of swamp species such as *Gahnia clarkei, Schoenus melanostachys, S. brevifolius, Baumea articulata* and *B. juncea*. A moderately dense cover of shrubs is present including *Acacia longifolia* subsp. *sophorae*. The ground cover can in clude common species such as *Lomandra longifolia* and *Pteridium esculentum*. In its present condition, knots of the vine *Marsdenia rostrata* are found amongst the ground and shrub layers. Coastal Sand Swa mp Mahogany Forest occurs on un consolidated sand deposits where the water table re mains in close proximity to the su rface. Swale s and depressions between sand dunes provide common habitat for this community. Drie r dune slopes and crests lose t he swamp species as the vegetation merges into Coastal Sand Bangalay-Blackbutt Forest.

Clearing and alterations to drain age patterns around the Windang sandmass has reduced the origina l distribution of this forest. Impa cts from high fire frequency and weed infestation are also highly visible. Most areas are affected by a smothering of Bitou bush (*Chrysanthemoides monilifera* var. *rotundata*) and *Lantana camara*.

NPWS (2000a) describes a forest dominated by *Eucalyptus robusta* (Forest Ecosystem 175: Northern Coastal Lowlands Swamp Forest) occurring in the Jervis Bay region. As a species profile is not available direct comparisons are difficult with Coastal Sand Swamp Mahogany Forest occurring within the Wollongong LGA. Large coastal sand masses north of Sydney support extensive areas of Swamp Mahogany Forest, although differences are marked by the abundance of *Melaleuca quinquenervia* in the canopy, a species not found in the Wollongong LGA.

❑ *FLORISTIC SUMMARY*

Number of Sites: 3

Trees: 10-15m tall. Mean Projected Canopy Cover 37%

Eucalyptus robusta, Eucalyptus pilularis, Eucalyptus botryoides

Shrubs: 1-6m tall. Mean Projected Canopy Cover 27%

Banksia integrifolia subsp. *integrifolia, Acacia longifolia* subsp. *sophorae, Allocasuarina littoralis*

Ground Covers: 0-1m tall. Mean projected Canopy Cover 75%

Gahnia clarkei, Lomandra longifolia, Baumea articulata, Baumea juncea, Schoenus brevifolius, Schoenus melanostachys, Trachymene anisocarpa, Pteridium esculentum, Billardiera scandens var. *scandens*

❑ *KEY IDENTIFYING FEATURES*

Easily recognisable features to assist in identifying this map unit are:

- Presence of Swamp mahogany (*Eucalyptus robusta*).
- Depressions and swales of Coastal Sand Dunes.
- High water table providing an understorey of some sedges (does depend on drainage modification to site) Zig-zag bog rush (*Schoenus brevifolius, S. melanostachys),* Jointed Twig Rush *(Baumea articulata)*, *B. juncea* and Tall saw sedge (*Gahnia clarkei*).

- Dense cover of Bracken (*Pteridium esculentum*).

❑ *EXAMPLE LOCATIONS*

Port Kembla Golf Course, Windang

❑ *CONSERVATION STATUS*

RESERVATION STATUS

Tenure	Study Area (ha)	Proportion of Total (%)	Sydney Basin Bioregion (ha/%)
National Park Estate	0	0	65 (14)
Water Catchment	0	0	
State Forest	0	0	
Wollongong City Council Reserves	3.09	24.9	
Reserved Subtotal	3.09	24.9	
Other	9.32	75.1	
Total	12.41	100	471

CONDITION ASSESSMENT

Disturbance Class	Area (ha)	Proportion Extant (%)
A Light	0	0
B Moderate	3.61	29.1
C Heavy	8.80	70.9
Scattered trees	0	0
Total	12.41	100

❑ *THREATENED PLANT SPECIES*

None recorded

❑ *DIAGNOSTIC SPECIES*

Species Name	Group Score	Group Freq	Non Group Score	Non Group Freq	Fidelity Class
Acacia longifolia subsp. longifolia	4	0.67	4	0.03	positive
Acacia rubida	2	0.33	0	0.00	positive
Banksia integrifolia subsp. integrifolia	2	0.67	4	0.07	positive
Baumea articulata	4	0.33	0	0.00	positive
Billardiera scandens	3	0.67	2	0.11	positive
Breynia oblongifolia	3	0.67	2	0.38	positive
Calystegia soldanella	1	0.33	0	0.00	positive
Cyperus polystachyos	4	0.33	0	0.00	positive
Dianella caerulea	2	0.67	1	0.26	positive
Entolasia marginata	4	1.00	2	0.25	positive
Eucalyptus pilularis	4	0.67	5	0.18	positive
Eucalyptus robusta	5	1.00	4	0.02	positive
Gahnia clarkei	3	1.00	6	0.01	positive
Gonocarpus micranthus	1	0.33	0	0.00	positive
Gonocarpus teucrioides	3	0.67	3	0.05	positive
Imperata cylindrica var. major	3	1.00	2	0.14	positive
Kennedia rubicunda	3	1.00	1	0.09	positive
Lomandra longifolia	3	1.00	2	0.45	positive
Pimelea linifolia	3	0.67	0	0.00	positive
Pteridium esculentum	4	1.00	2	0.17	positive

Species Name	Group Score	Group Freq	Non Group Score	Non Group Freq	Fidelity Class
Schoenus brevifolius	6	0.67	0	0.00	positive
Eustrephus latifolius	0	0.00	2	0.68	negative
Geitonoplesium cymosum	0	0.00	2	0.64	negative
Notelaea venosa	0	0.00	3	0.58	negative
Oplismenus imbecillis	0	0.00	3	0.60	negative
Pandorea pandorana subsp. pandorana	0	0.00	2	0.65	negative
Pittosporum undulatum	0	0.00	2	0.64	negative
Pseuderanthemum variabile	0	0.00	3	0.62	negative
Marsdenia rostrata	3	1.00	2	0.56	constant

MU35 Alluvial Swamp Mahogany Forest

❑ *DESCRIPTION*

At Bellambi Wetlands adjoining Bellambi Lagoon a small stand of *Eucalyptus robusta* and *E. botryoides* represents the one of the few remnants of Alluvial Swamp Mahogany Forest in the Wollongong LGA. This map unit is likely to have occupied low-lying estuarine alluvial flats on the coastal floodplains. Clearing and land fill for sporting fields occupy much of the former extent of this forest. At present, the species composition of this community is defined by the Bellambi remnant. The community here comprises a low canopy of *Eucalyptus robusta, E. botryoides, Casuarina glauca* and large examples of *Melaleuca linariifolia*. Mature *Parsonsia straminea* vines hang from the canopy above a dense cover of *Gahnia clarkei, Carex appressa* and *Phragmites australis*. Moist forest species are also present, although in low abundance. These include *Synoum glandulosum* subsp. *glandulosum*, *Glochidion ferdinandi, Ficus coronata* and *Pittosporum* spp. This map unit supports similar canopy species to Coastal Sand Swamp Mahogany Forest. However, the influence of the sandy soil in the vegetation composition in the former is not expressed on the assemblage present on the deep black alluvial soils.

NPWS (2000a) describes a forest dominated by *Eucalyptus robusta* (Forest Ecosystem 175: Northern Coastal Lowlands Swamp Forest) occurring in the Jervis Bay region. As a species profile is not available direct comparisons are difficult with Alluvial Swamp Mahogany Forest occurring within the Wollongong LGA. The site at Bellambi aligned to other Alluvial Moist Swamp Mahogany Forests found at Gosford and Wyong on the Central Coast.

Alluvial Swamp Mahogany Forest forms a component of the Sydney Coastal Estuary Swamp Forest Complex, an endangered Ecological Community listed under the Threatened Species Act (1995).

❑ *FLORISTIC SUMMARY*

Number of Sites: ***1***

Trees: 10-12m tall. Mean Projected Canopy Cover 60%

Eucalyptus robusta, Eucalyptus botryoides, Casuarina glauca

Shrubs: 1-2m tall. Mean Projected Canopy Cover 60%

Glochidion ferdinandi, Melaleuca linariifolia, Pittosporum undulatum, Pittosporum revolutum

Ground Cover: 0-1m tall. Mean Projected Canopy Cover 50%

Gahnia clarkei, Carex appressa, Viola hederacea, Phragmites australis

Vines

Parsonsia straminea

❑ *KEY IDENTIFYING FEATURES*

Easily recognisable features to assist in identifying this map unit are:

- Forest dominated by Swamp mahogany *(E. robusta*) and/or Bangalay (*Eucalyptus botryoides*) and Swamp Oak (*Casuarina glauca*) on alluvial depressions, terraces and riparian strips in estuarine environments.
- Distinctive combination of swampy ground cover species including Tall saw sedge (*Gahnia clarkei*), Common reed (*Phragmites australis*), and Tall sedge (*Carex appressa*).

❑ *EXAMPLE LOCATIONS*

Bellambi Lagoon; Wollingurry Swamp

❑ *CONSERVATION STATUS*

Forms a co mponent of the Sydney Coastal Estu ary Swamp Fo rest Complex, an endang ered Ecological Community listed under the Threatened Species Act (1995).

RESERVATION STATUS

Tenure	Study Area (ha)	Proportion of Total (%)	Sydney Basin Bioregion (ha/%)
National Park Estate	0	0	475 (9)
Water Catchment	0	0	
State Forest	0	0	
Wollongong City Council Reserves	9.17	25.9	
Reserved Subtotal	9.17	25.9	
Other	26.28	74.1	
Total	35.45	100	5222

CONDITION ASSESSMENT

Disturbance Class	Area (ha)	Proportion Extant (%)
A Light	0	0
B Moderate	17.75	50.1
C Heavy	7.25	20.5
Scattered trees	10.45	29.5
Total	35.45	100

❑ *THREATENED PLANT SPECIES*

None recorded

❑ *DIAGNOSTIC SPECIES*

Species Name	Group Score	Group Freq	Non Group Score	Non Group Freq	Fidelity Class
Calystegia sepium	2	1	2	0.03	positive
Carex appressa	4	1	2	0.09	positive
Casuarina glauca	4	1	3	0.06	positive
Commelina cyanea	2	1	2	0.33	positive
Eucalyptus botryoides	4	1	4	0.15	positive

Species Name	Group Score	Group Freq	Non Group Score	Non Group Freq	Fidelity Class
Eucalyptus robusta	4	1	4	0.03	positive
Gahnia clarkei	6	1	3	0.02	positive
Melaleuca linariifolia	4	1	5	0.01	positive
Omalanthus populifolius	2	1	1	0.12	positive
Parsonsia straminea	4	1	1	0.35	positive
Phragmites australis	2	1	3	0.03	positive
Synoum glandulosum subsp. glandulosum	2	1	2	0.40	positive
Viola hederacea	3	1	2	0.13	positive

MU36 Coastal Swamp Oak Forest

❑ *DESCRIPTION*

Dense stands of *Casuarina glauca* occur in estuarine environments that include low-lying areas on the coastal floodplain, and on the fringes of lakes and lagoons. Coastal Swamp Oak Forest most often supports a simple forest structure with only a mat of herbs, rushes and sedges covering the ground below a monospecific stand of *Casuarina glauca*. The understorey characteristics can be variable depending on the balance of freshwater and brackish influences. The rush *Phragmites australis* is a regular component of the understorey with the sedge *Juncus kraussii* subsp. *australiensis* and forbs *Atriplex australasica* and *Commelina cyanea* also common.

Remnant patches of Coastal Swamp Oak Forest are now reduced to narrow ribbons and fringes. Weeds are present in large numbers where the canopy has been opened to improve grazing potential. There has been extensive clearing and alteration to this community, particularly with wetland drainage, urban development and grazing activity.

Coastal Swamp Oak Forest appears closely aligned with Forest Ecosystem 25 South Coast Swamp Forest Complex (NPWS, 2000a) for the South Coast region. This complex is found between Shellharbour and Wallaga Lake. The report indicates that the Ecosystem is heavily cleared and poorly reserved in the south coast region.

Stands of pure *Casuarina glauca* are specifically excluded from the Sydney Coastal Estuary Swamp Forest Complex, an endangered Ecological Community listed under the Threatened Species Act (1995). However, users should note that small, unmapped areas of this Endangered Community may exist within Coastal Swamp Oak Forest Map Unit.

❑ *FLORISTIC SUMMARY*

Number of Sites: 3

Trees: 8-15m tall. Mean Projected Canopy Cover 50%

Casuarina glauca

Sedges and Rushes: 0.5-1.5m tall. Mean Projected Canopy Cover 5%

Phragmites australis, Juncus kraussii subsp. *australiensis*

Ground covers: 0-0.5m tall. Mean Projected Canopy Cover 90%

Cynodon dactylon, Commelina cyanea, Samolus repens, Alternanthera denticulata

❑ *KEY IDENTIFYING FEATURES*

Easily recognisable features to assist in identifying this map unit are:

- Dense stands of Swamp oak (*Casuarina glauca*) surrounding lakes, estuaries and lagoons.

❑ *EXAMPLE LOCATIONS*

Puckeys Estate; Picnic Island; Bellambi Lagoon.

❑ *CONSERVATION STATUS*

Small, unmapped areas of Sydney Coastal E stuary Swamp Forest Complex, an enda ngered Ecological Community listed under the Threatened Species Act (1995), may exist within Coastal Swamp Oak Forest.

RESERVATION STATUS

Tenure	Study Area (ha)	Proportion of Total (%)	Sydney Basin Bioregion (ha/%)
National Park Estate	2.15	0.9	648 (15)
Water Catchment	0	0	
State Forest	0	0	
Wollongong City Council Reserves	47.24	19.6	
Reserved Subtotal	49.39	20.5	
Other	191.96	79.5	
Total	241.35	100	4343

CONDITION ASSESSMENT

Disturbance Class	Area (ha)	Proportion Extant (%)
A Light	17.2	7.1
B Moderate	114.14	47.3
C Heavy	90.35	37.4
Scattered trees	19.66	8.1
Total	241.35	100

❑ *THREATENED PLANT SPECIES*

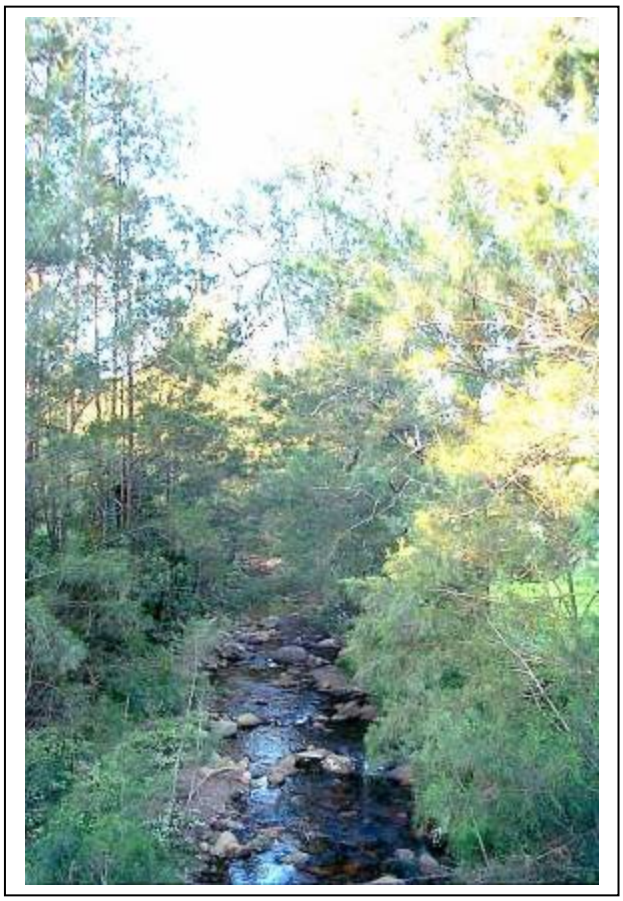
None recorded

❑ *DIAGNOSTIC SPECIES*

Species Name	Group Score	Group Freq	Non Group Score	Non Group Freq	Fidelity Class
Alternanthera denticulata	3	0.75	0	0.00	positive
Apium prostratum	2	0.75	0	0.00	positive
Atriplex australasica	3	1.00	1	0.01	positive
Calystegia sepium	3	0.50	2	0.02	positive
Casuarina glauca	5	1.00	4	0.04	positive
Commelina cyanea	3	0.75	2	0.32	positive
Crinum pedunculatum	3	0.25	0	0.00	positive
Cynodon dactylon	4	0.75	3	0.03	positive
Juncus kraussii subsp. australiensis	4	0.75	3	0.01	positive
Phragmites australis	4	1.00	2	0.02	positive
Samolus repens	4	0.50	1	0.01	positive
Selliera radicans	2	0.25	0	0.00	positive
Sporobolus virginicus	6	0.50	0	0.00	positive
Tetragonia tetragonioides	3	0.50	2	0.01	positive
Eustrephus latifolius	0	0.00	2	0.68	negative
Geitonoplesium cymosum	0	0.00	2	0.65	negative
Marsdenia rostrata	0	0.00	2	0.59	negative
Notelaea venosa	0	0.00	3	0.58	negative
Oplismenus imbecillis	2	0.25	3	0.60	negative
Pandorea pandorana subsp. pandorana	0	0.00	2	0.66	negative
Pittosporum undulatum	1	0.25	2	0.64	negative
Pseuderanthemum variabile	0	0.00	3	0.62	negative

MU37 Riparian River Oak Forest

❑ *DESCRIPTION*



Riparian River Oak Forest features narrow ribbons of tall *Casuarina cunninghamiana* subsp. *cunninghamiana* along Macquarie Rivulet and Marshall Mount Creek in the Calderwood Valley. Remnants remain as discontinuous patches along the banks of these streams. Other tree species include *Eucalyptus tereticornis* and *E. salignaXbotryoides*.

The remnants of this community are heavily degraded by past clearing and ongoing grazing activities. Weeds dominate the understorey, particularly *Lantana camara* and Privet (*Ligustrum* spp.) and exotic trees such as Camphor laurel (*Cinnamomum camphora*) and Coral tree (*Erythrina X sykesii*).

No formal survey sites have been completed in this map unit. *Casuarina cunninghamiana* subsp. *cunninghamiana* is widespread across coastal floodplains and tableland riverine systems of NSW. Variation between understorey species that occur as both a result of disturbance and regional influences are poorly understood. Riparian River Oak Forest is likely to form part of a complex of south coast riverine vegetation systems extending south into the Bega Region (Keith & Bedward, 1999).

❑ *FLORISTIC SUMMARY*

Number of Sites: ***None (Species noted here include site data from NCC (1999))***

Trees: 35m tall. Mean Projected Canopy Cover 40%

Casuarina cunninghamiana subsp. *cunninghamiana, Eucalyptus tereticornis*

Shrubs: Variable to 15m tall. Mean Projected Canopy Cover 45%

Alphitonia excelsa, Pittosporum undulatum, Ficus coronata, Acacia mearnsii, Acacia binervata

Ground Cover

Lomandra longifolia, Dichondra repens, Urtica incisa

❑ *KEY IDENTIFYING FEATURES*

Easily recognisable features to assist in identifying this map unit are:

- Narrow ribbons of River oak (*Casuarina cunninghamiana* subsp. *cunninghamiana*) along Macquarie Rivulet and Marshall Mount Creek within open paddocks.

❑ *EXAMPLE LOCATIONS*

Macquarie Rivulet; Marshall Mount Creek

❑ *CONSERVATION STATUS*

RESERVATION STATUS

Tenure	Study Area (ha)	Proportion of Total (%)	Sydney Basin Bioregion (ha/%)
National Park Estate	0.80	0.8	1 (0.2)
Water Catchment	0	0	
State Forest	0	0	
Wollongong City Council Reserves	0.20	0.2	
Reserved Subtotal	1.0	1.0	
Other	103.62	99.0	
Total	104.62	1.0	441

CONDITION ASSESSMENT

Disturbance Class	Area (ha)	Proportion Extant (%)
A Light	0	0
B Moderate	14.02	13.4
C Heavy	88.69	84.8
Scattered trees	1.91	1.8
Total	104.62	100

❑ *THREATENED PLANT SPECIES*

None recorded

❑ *DIAGNOSTIC SPECIES*

No Diagnostic Species are available as no formal sites completed in this Map Unit.

MU38 Highlands Swamp Gum-*Melaleuca* Woodland

❑ *DESCRIPTION*

At Macquarie Hill on the plateau in the far south of the Study Area, an outcropping of Robertson Basalt occurs, ringed by remnant Wianamatta Shales and Hawkesbury sandstones. On these gently sloping shales, an apparent seepage or water discharge provides sufficient moisture for the development of a dense wet scrub. A low canopy comprising *Eucalyptus ovata* and *Melaleuca linariifolia* is characteristic. It also supports a shrubby understorey of *Melaleuca squarrosa*, *Leptospermum polygalifolium* subsp. *polygalifolium*, *Hakea salicifolia* and *Banksia spinulosa* var. *spinulosa* and graminoids dominated by *Lomandra longifolia* and *Schoenus melanostachys*. *Eucalyptus ovata* swamps appear to occupy sites at which geology grades from Basalt into Wianamatta Shale particularly on the Robertson Plateau. At many of these sites the *E. ovata* are taller with an open grassy understorey and do not share sandstone shrub species present at Macquarie Hill.

NPWS (2000a) describe a Moist Heath Community (Forest Ecosystem 144) of which several positive diagnostic species are shared with Highlands Swamp Gum-*Melaleuca* Woodland. Further regional analysis will clarify these relationships. At present the site at Macquarie Hill is protected by water catchment land use.

❑ *FLORISTIC SUMMARY*

Number of Sites: ***1***

Trees: 8-12m tall. Mean Projected Canopy Cover 25%

Eucalyptus ovata, Melaleuca linariifolia

Shrubs: 4-8m tall. Mean Projected Canopy Cover 60%

Melaleuca linariifolia, Melaleuca squarrosa, Leptospermum polygalifolium subsp. *polygalifolium, Pultenaea blakelyi*

Ground Cover: 0-1m tall. Mean Projected Canopy Cover 90%

Lomandra longifolia, Schoenus melanostachys

❑ *KEY IDENTIFYING FEATURES*

Easily recognisable features to assist in identifying this map unit are:

- Low dense scrub near Macquarie Hill on the plateau with dense shrubs of Pape rbark (*Melaleuca linariifolia*).
- Dense ground cover of Black bog rush (*Schoenus melanostachys*).
- Low cover of Swamp gums (*Eucalyptus ovata*).

❑ *EXAMPLE LOCATIONS*

Macquarie Hill

❑ *CONSERVATION STATUS*

RESERVATION STATUS

Tenure	Study Area (ha)	Proportion of Total (%)	Sydney Basin Bioregion (ha/%)
National Park Estate	0.21	2.0	0.2 (0.1)
Water Catchment	8.34	77.7	144 (100)
State Forest	0	0	
Wollongong City Council Reserves	0	0	
Reserved Subtotal	8.55	79.6	
Other	2.19	20.4	
Total	10.74	100	>144

CONDITION ASSESSMENT

Disturbance Class	Area (ha)	Proportion Extant (%)
A Light	10.02	93.3
B Moderate	0.72	6.7
C Heavy	0	0
Scattered trees	0	0
Total	10.74	100

❑ *THREATENED PLANT SPECIES*

None recorded

❑ *DIAGNOSTIC SPECIES*

Species Name	Group Score	Group Freq	Non Group Score	Non Group Freq	Fidelity Class
Banksia spinulosa var. spinulosa	4	1	1	0.02	positive
Callistemon citrinus	2	1	0	0	positive
Empodisma minus	4	1	4	0.01	positive
Entolasia stricta	2	1	3	0.13	positive
Eucalyptus ovata	4	1	0	0	positive
Gonocarpus teucrioides	4	1	3	0.05	positive
Goodenia paniculata	2	1	0	0	positive
Hakea salicifolia	4	1	2	0.02	positive
Hibbertia aspera subsp. aspera	3	1	2	0.03	positive
Hibbertia scandens	2	1	1	0.20	positive
Leptospermum polygalifolium subsp. polygalifolium	4	1	4	0.02	positive
Leucopogon lanceolatus var. lanceolatus	2	1	2	0.07	positive

Species Name	Group Score	Group Freq	Non Group Score	Non Group Freq	Fidelity Class
Lomandra longifolia	5	1	2	0.45	positive
Melaleuca linariifolia	5	1	4	0.01	positive
Melaleuca squarrosa	4	1	1	0.01	positive
Pratia purpurascens	2	1	2	0.16	positive
Pultenaea blakelyi	2	1	2	0.02	positive
Schoenus melanostachys	5	1	3	0.01	positive
Tmesipteris truncata	1	1	0	0	positive
Eustrephus latifolius	0	0	2	0.67	negative
Geitonoplesium cymosum	0	0	2	0.64	negative
Marsdenia rostrata	0	0	2	0.58	negative
Notelaea venosa	0	0	3	0.58	negative
Oplismenus imbecillis	0	0	3	0.59	negative
Pandorea pandorana subsp. pandorana	0	0	2	0.65	negative
Pittosporum undulatum	0	0	2	0.63	negative
Pseuderanthemum variabile	0	0	3	0.61	negative

MU39 Coastal Sand Freshwater Wetland

❑ *DESCRIPTION*

Coastal Sand Freshwater Wetland occurs on poorly drained sands and sediments along the coastline zone. A dense cover of *Melaleuca ericifolia* forms thickets (4-8m) above a cover of sedges and rushes. At Korrungulla Wetland, the dominant ground cover is *Cladium procerum*, although elsewhere it may include *Baumea juncea*, *Phragmites australis* and *Gahnia clarkei*. Moderately deep standing water or soaks are often present throughout the year. Scattered emergent *Casuarina glauca* may be present.

Other sites of similar floristic composition occur at Dunmore Wetland (Mills, 2000) in Shellharbour LGA and at Bundeena Swamp in Royal National Park. NPWS (2000a) also describe a similar ecosystem (Coastal Wet Heath Swamp Forest) that occurs on tributaries of coastal lagoons between Seven Mile Beach and Bermagui on the South Coast.

The combination of species present within this community match those described by Sydney Freshwater Wetlands, an Endangered Ecological Community listed under the Threatened Species Conservation Act (1995). Coomaditchy Lagoon is presented in the final determination as an example of the Endangered Community.

❑ *FLORISTIC SUMMARY*

Number of Sites: ***1***

Trees: 10-12m tall. Mean Projected Canopy Cover 5%

Casuarina glauca

Shrubs: 4-8m tall. Mean Projected Canopy Cover 30%

Melaleuca ericifolia

Sedges and Rushes: 0-1.5m tall. Mean Projected Canopy Cover 80%

Cladium procerum, Phragmites australis, Baumea juncea, Juncus kraussii subsp. *australiensis*

❑ *KEY IDENTIFYING FEATURES*

Easily recognisable features to assist in identifying this map unit are:

- Near the fringes of coastal lagoons and estuaries on sandy soil.
- Dense thickets of Paperbark (*Melaleuca ericifolia*).
- Standing water.

- Isolated stands of Swamp Oak (*Casuarina glauca*).

❑ *EXAMPLE LOCATIONS*

Korrungulla Wetland; Coomaditchy Lagoon; Bundeena Swamp.

❑ *CONSERVATION STATUS*

Forms a component of Sydney Freshwater Wetlands, an Endangered Ecological Community listed under the Threatened Species Conservation Act (1995).

RESERVATION STATUS

Tenure	Study Area (ha)	Proportion of Total (%)	Sydney Basin Bioregion (ha/%)
National Park Estate	0	0	816 (10)
Water Catchment	0	0	
State Forest	0	0	
Wollongong City Council Reserves	2.46	73.9	
Reserved Subtotal	2.46	73.9	
Other	0.87	26.1	
Total	3.33	100	8533

CONDITION ASSESSMENT

Wetland communities were not assessed, due to the difficulty in determining disturbance. However, it is likely that they have been significantly modified from their original condition.

❑ *THREATENED PLANT SPECIES*

None recorded

❑ *DIAGNOSTIC SPECIES*

Species Name	Group Score	Group Freq	Non Group Score	Non Group Freq	Fidelity Class
Cladium procerum	6	1	0	0.00	positive
Melaleuca ericifolia	7	1	0	0.00	positive
Phragmites australis	3	1	3	0.03	positive
Eustrephus latifolius	0	0	2	0.67	negative
Geitonoplesium cymosum	0	0	2	0.64	negative
Marsdenia rostrata	0	0	2	0.58	negative
Notelaea venosa	0	0	3	0.58	negative
Oplismenus imbecillis	0	0	3	0.59	negative
Pandorea pandorana subsp. pandorana	0	0	2	0.65	negative
Pittosporum undulatum	1	1	2	0.63	negative
Pseuderanthemum variabile	0	0	3	0.61	negative

MU40 Upland Swamps: Tea-tree Thicket

❑ *DESCRIPTION*

A low dense blend of Coral ferns (*Gleichenia dicarpa, G. microphylla*) and sedges (*Gahnia sieberiana, Empodisma minus*) are found along drainage lines within the Sedgeland-Heath Complex on soils with impeded drainage of the Woronora Plateau. Tea-trees (*Leptospermum juniperinum*), *Acacia rubida*, *Banksia ericifolia* subsp. *ericifolia* and *Melaleuca squarrosa* may form dense thickets to a height of three metres in height. These thickets may be sparse to absent depending on water table fluctuation and long term fire history (Keith, 1994). Occasional individuals of *Banksia robur* and *Conospermum ellipticum* are present in the sparse low shrub layer. Other ground covers may include *Lepidosperma laterale, Baumea teretifolia* and *Tetrarrhena juncea*.

Keith (1994) describes an identical community of the same name in the O'Hares Creek Catchment. Survey sites in Avon and Cordeaux Catchments and Royal National Park indicate that Tea-tree Thicket occurs across the extent of the Woronora Plateau, although the Maddens Plains area supports the largest patches within its distribution (NPWS, 2002).

❑ *FLORISTIC SUMMARY*

Number of Sites: 4

Shrubs: 3 metres up to 40% cover

Banksia ericifolia subsp. *ericifolia, Leptospermum juniperinum, Acacia rubida, Melaleuca squarrosa, Banksia robur, Banksia ericifolia*

Sedges and Rushes: 1.5 metres 70-90% cover

Gleichenia microphylla, Gleichenia dicarpa, Gahnia sieberiana, Empodisma minus, Lepyrodia anarthria, Blechnum nudum

❑ *KEY IDENTIFYING FEATURES*

Easily recognisable features to assist in identifying this map unit are:

- A ribbon of Tea-tree (*Leptospermum* spp.) thickets, *Banksia ericifolia* subsp. *ericifolia* within upland swamps on the Woronora Plateau.
- Dense scramble of Coral Ferns (*Gleichenia* spp.) and sedges including *Gahnia sieberiana*.

❑ *EXAMPLE LOCATIONS*

Maddens Plains; Bulli Tops

❑ *CONSERVATION STATUS*

RESERVATION STATUS

Tenure	Study Area (ha)	Proportion of Total (%)	Sydney Basin Bioregion (ha/%)
National Park Estate	2.75	9.3	41830
Water Catchment	4.93	16.7	170
State Forest	0	0	
Wollongong City Council Reserves	0	0	
Reserved Subtotal	7.68	26.0	
Other	21.81	74.0	
Total	29.49	100	>47000*

*Upland Swamp communities have not been mapped separately outside this report.

CONDITION ASSESSMENT

Disturbance Class	Area (ha)	Proportion Extant (%)
A Light	29.49	100
B Moderate	0	0
C Heavy	0	0
Scattered trees	0	0
Total	100	100

❑ *THREATENED PLANT SPECIES*

None recorded

❑ *DIAGNOSTIC SPECIES*

Species Name	Group Score	Group Freq	Non Group Score	Non Group Freq	Fidelity Class
Acacia elongata	2	0.50	1	0.01	positive
Banksia ericifolia subsp. ericifolia	5	1.00	2	0.22	positive
Banksia oblongifolia	2	1.00	2	0.15	positive
Bauera rubioides	3	0.50	2	0.05	positive
Blechnum indicum	2	0.50	1	0.01	positive
Bossiaea stephensonii	3	0.50	1	0.01	positive
Callistemon citrinus	2	0.50	1	0.01	positive
Eurychorda complanata	2	0.50	2	0.03	positive
Gahnia sieberiana	2	1.00	2	0.07	positive
Gleichenia dicarpa	5	0.50	2	0.08	positive
Gleichenia microphylla	3	0.50	3	0.03	positive
Hakea dactyloides	3	0.50	2	0.30	positive
Hakea teretifolia	2	1.00	2	0.10	positive
Lepidosperma laterale	2	1.00	1	0.34	positive
Leptocarpus tenax	2	0.50	2	0.08	positive
Leptospermum juniperinum	3	1.00	2	0.03	positive
Leptospermum polygalifolium subsp. polygalifolium	2	0.50	2	0.13	positive
Melaleuca squarrosa	2	0.50	2	0.01	positive
Platysace linearifolia	2	0.50	2	0.29	positive
Schoenus brevifolius	3	1.00	1	0.02	positive
Selaginella uliginosa	2	0.50	2	0.08	positive

MU41 Upland Swamps: Banksia Thicket

❑ *DESCRIPTION*

Banksia Thicket describes a low dense heath that forms on the fringes of the upland swamp complex within the O'Hares Creek catchment (Keith, 1994). These thickets extend beyond this catchment to cover similar habitat across the Woronora Plateau. These thickets are typified by an abundance of *Banksia ericifolia* subsp. *ericifolia* and *Hakea dactyloides* that occur in combination with *B. oblongifolia, Pultenaea aristata* and *Dillwynia floribunda*. Species common to the upland swamps and Exposed Sandstone Scribbly Gum Woodlands occur in the understorey. *Empodisma minus, Dampiera stricta, Entolasia stricta, Selaginella stricta* and *Leptocarpus tenax* feature within a highly variable ground cover.

Banksia Thickets occur throughout the Woronora Plateau. In some locations *Banksia ericifolia* subsp. *ericifolia* completely dominates the understorey of adjoining stands of Exposed Sandstone Scribbly Gum Woodland. These areas have been included within this Map Unit although the species composition will vary from that found growing within the upland swamp complex. Areas of dense *Banksia ericifolia* subsp. *ericifolia* growing on broad rock plates are also included within the Map Unit.

❑ *FLORISTIC SUMMARY*

Number of Sites: ***3***

Trees: ***10-15 metres, 5-20% cover***

Eucalyptus sclerophylla, Corymbia gummifera, Eucalyptus sieberi

Shrubs:3 metres up to 40% cover

Banksia ericifolia subsp. *ericifolia, Hakea dactyloides*

Sedges and Rushes: 1.5 metres 70-90% cover

Tetrarrhena turfosa, Selaginella uliginosa, Lindsaea linearis, Empodisma minus, Leptocarpus tenax, Entolasia stricta, Cassytha glabella

❑ *KEY IDENTIFYING FEATURES*

Easily recognisable features to assist in identifying this map unit are:

- Dense thickets of *Banksia ericifolia* subsp. *ericifolia* adjoining upland swamps on the Woronora Plateau, underneath adjoining Exposed Sandstone Scribbly Gum Woodland or on rock plates.

❑ *EXAMPLE LOCATIONS*

Maddens Plains; Stanwell Tops

❑ *CONSERVATION STATUS*

RESERVATION STATUS

Tenure	Study Area (ha)	Proportion of Total (%)	Sydney Basin Bioregion (ha/%)
National Park Estate	0.46	0.3	41830
Water Catchment	37.77	27.1	1120
State Forest	0.28	0.2	
Wollongong City Council Reserves	0	0	
Reserved Subtotal	38.51	27.6	
Other	100.94	72.4	
Total	139.45	100	>47000*

*Upland Swamp communities have not been mapped separately outside this report.

CONDITION ASSESSMENT

Disturbance Class	Area (ha)	Proportion Extant (%)
A Light	133.35	95.6
B Moderate	4.27	3.1
C Heavy	1.83	1.3
Scattered trees	0	0
Total	139.45	100

❑ *THREATENED PLANT SPECIES*

None recorded

❑ *DIAGNOSTIC SPECIES*

Species Name	Group Score	Group Freq	Non Group Score	Non Group Freq	Fidelity Class
Acacia terminalis	2	0.67	1	0.25	positive
Banksia ericifolia subsp. ericifolia	5	1.00	2	0.22	positive
Banksia robur	3	0.67	2	0.02	positive
Cassytha pubescens	2	0.67	1	0.23	positive
Empodisma minus	3	1.00	2	0.08	positive
Entolasia stricta	2	0.67	2	0.49	positive
Epacris microphylla var. microphylla	2	1.00	2	0.13	positive
Epacris obtusifolia	2	1.00	2	0.04	positive
Gleichenia dicarpa	2	0.67	2	0.08	positive
Hakea teretifolia	3	0.67	2	0.14	positive
Leptocarpus tenax	2	1.00	2	0.08	positive
Leptospermum squarrosum	3	1.00	2	0.06	positive
Leptospermum trinervium	2	1.00	2	0.40	positive
Lindsaea linearis	2	0.67	1	0.18	positive
Sprengelia incarnata	2	0.67	2	0.02	positive

MU42 Upland Swamps: Sedgeland-Heath Complex

(a) Sedgeland

- ***DESCRIPTION***

Sedgeland is distinct component of this map unit that forms part of the Upland Swamp Complex on the Woronora Plateau. Sites from the Holsworthy area (French *et al*., 2000) reflect a closely related species composition to that described by Keith (1994) for O'Hares Creek Catchment. Sedgeland forms a low dense cover of sedges and small shrubs on the perimeter of upland swamps or in minor depressions within the same complex. *Leptocarpus tenax, Schoenus brevifolius* and *S. paludosus* are consistently found in high abundance. The low shrub layer features *Baeckea imbricata*, *Epacris obtusifolia*, *Sprengelia incarnata*, *Symphionema paludosum*, and *Boronia parviflora*. *Hakea teretifolia* and *Banksia ericifolia* subsp. *ericifolia* occur occasionally at low abundance. Other ground cover species include *Ptilothrix deusta*, *Actinotus minor* and *Selaginella uliginosa*.

Keith (1994) found that Sedgeland occupied about 10% of this Sedgeland-Heathland in the O'Hares Creek Catchment. This community is difficult to distinguish using aerial photo patterns. However, a number of small isolated localities have been mapped in Woronora, Cataract and Avon Catchments during field traverses. As a result the total area of this community is unknown. Elsewhere, Sedgeland is know to occur in Holsworthy Military area and Keith (1994) notes that it is likely to be very limited in Royal National Park.

- ***FLORISTIC SUMMARY***

Number of Sites: 3

Shrubs: 0.5-1m. Mean Projected Cover 30%

Baeckea imbricata, Epacris obtusifolia, Epacris microphylla var. *microphylla, Sprengelia incarnata, Symphionema paludosum, Boronia parviflora, Hakea teretifolia, Banksia ericifolia* subsp. *ericifolia, Pimelea linifolia* subsp. *linifolia, Dillwynia floribunda*

Ground covers: 0-0.5 m tall. Mean Projected Canopy Cover 70%

Leptocarpus tenax, Schoenus brevifolius, Schoenus paludosus, Lepyrodia scariosa, Ptilothrix deusta, Dampiera stricta, Stylidium graminifolium

❑ *KEY IDENTIFYING FEATURES*

Easily recognisable features to assist in identifying this map unit are:

- A low treeless plain dominated by sedges and rushes, such as *Leptocarpus tenax* and *Schoenus brevifolius.*

❑ *EXAMPLE LOCATIONS*

Forest Walk, Darkes Forest; Dharawal State Conservation Area; Woronora Catchment

❑ *DIAGNOSTIC SPECIES*

Species Name	Group Score	Group Freq	Non Group Score	Non Group Freq	Fidelity Class
Boronia parviflora	2	0.67	1	0.01	positive
Dillwynia floribunda	3	0.67	1	0.06	positive
Drosera spatulata	2	0.67	2	0.04	positive
Epacris microphylla var. microphylla	2	1.00	2	0.20	positive
Epacris obtusifolia	4	0.67	2	0.06	positive
Haemodorum corymbosum	2	0.67	1	0.07	positive
Hakea teretifolia	2	0.67	2	0.23	positive
Leptocarpus tenax	4	1.00	2	0.13	positive
Lepyrodia scariosa	2	0.67	2	0.34	positive
Lycopodiella lateralis	2	0.33	0	0.00	positive
Ptilothrix deusta	2	1.00	2	0.14	positive
Schoenus brevifolius	4	1.00	1	0.04	positive
Schoenus paludosus	2	0.67	0	0.00	positive
Selaginella uliginosa	4	0.67	2	0.13	positive
Sprengelia incarnata	4	0.67	2	0.03	positive
Stylidium graminifolium	2	1.00	1	0.10	positive
Symphionema paludosum	3	0.67	1	0.01	positive
Corymbia gummifera	0	0.00	2	0.52	negative
Entolasia stricta	1	0.33	2	0.53	negative

(b) Restioid Heath

❑ *DESCRIPTION*

Restioid Heath forms part of the upland swamp complex found on the Woronora Plateau (Keith, 1994). A low shrub layer of *Banksia oblongifolia, Hakea teretifolia* and *Epacris obtusifolia* consistently occur with occasional *B. robur, Melaleuca thymifolia* and *M. squarrosa*. A diverse combination of rushes, herbs and grasses are present forming a dense ground cover. Species present include *Empodisma minus, Lepyrodia scariosa, Leptocarpus tenax, Lindsaea linearis, Xanthorrhoea resinifera, Stackhousia nuda, Mitrasacme polymorpha* and *Schoenus brevifolius*.

Restioid Heath has been mapped as a Sedgeland-Heath Complex (*sensu*. Keith, 1994). It occurs extensively on the Maddens Plains and in Avon and Woronora Catchments in smaller patches. Keith (1994) suggests there are similar, though restricted, communities present in Royal, Ku-ring-gai Chase and Brisbane Water National Parks.

❑ *FLORISTIC SUMMARY*

Number of Sites: 5

Shrubs: 1m tall. Mean Projected Canopy Cover 40%

Banksia oblongifolia, Hakea teretifolia, Epacris obtusifolia

Ground Cover: 0.5 tall. Mean Projected Canopy Cover 70-90%

Empodisma minus, Lepyrodia scariosa, Leptocarpus tenax, Lindsaea linearis, Xanthorrhoea resinifera, Stackhousia nuda, Mitrasacme polymorpha, Schoenus brevifolius

❑ *KEY IDENTIFYING FEATURES*

Easily recognisable features to assist in identifying this map unit are:

- Large open treeless swamps on the Woronora plateau.
- An open to dense heath layer comprising *Banksia oblongifolia* and *Hakea teretifolia.*
- A dense understorey of rushes from the family Restionaceae including *Lepyrodia scariosa, Leptocarpus tenax* and *Empodisma minus* as the dominant species.

❑ *EXAMPLE LOCATIONS*

Maddens Plains

❑ *THREATENED PLANT SPECIES*

None recorded

❑ *DIAGNOSTIC SPECIES*

(Note that Abundance Scores are derived from a 1-6 Braun Blanquet Cover Scale)

Species Name	Group Score	Group Freq	Non Group Score	Non Group Freq	Fidelity Class
Actinotus minor	2	0.5	2	0.20	positive
Agrostis avenacea var. avenacea	2	0.7	2	0.04	positive
Baeckea imbricata	2	0.5	2	0.03	positive
Banksia oblongifolia	3	0.9	2	0.14	positive
Banksia robur	3	0.5	2	0.02	positive
Baumea acuta	2	0.5	1	0.01	positive
Baumea teretifolia	2	0.7	2	0.01	positive
Burchardia umbellata	2	0.6	1	0.02	positive
Cassytha glabella forma glabella	2	0.9	1	0.15	positive
Cyathochaeta diandra	3	0.5	2	0.27	positive
Dichopogon fimbriatus	1	0.1	0	0.00	positive
Eleocharis sphacelata	2	0.5	2	0.01	positive
Empodisma minus	3	1.0	2	0.07	positive
Entolasia stricta	2	0.8	2	0.49	positive
Epacris obtusifolia	2	1.0	2	0.03	positive
Epaltes australis	1	0.1	0	0.00	positive
Eurychorda complanata	2	0.7	2	0.01	positive
Euryomyrtus ramosissima subsp. ramosissima	2	0.6	1	0.01	positive
Hakea teretifolia	3	0.9	2	0.14	positive
Lepidosperma longitudinale	2	0.1	0	0.00	positive
Lepidosperma neesii	2	0.5	2	0.02	positive
Leptocarpus tenax	3	0.9	2	0.08	positive
Leptospermum arachnoides	2	0.7	1	0.12	positive
Lepyrodia scariosa	3	1.0	2	0.23	positive
Lindsaea linearis	2	0.9	1	0.17	positive
Mitrasacme polymorpha	2	0.9	2	0.09	positive
Selaginella uliginosa	2	0.7	2	0.07	positive

Species Name	Group Score	Group Freq	Non Group Score	Non Group Freq	Fidelity Class
Tetrarrhena turfosa	2	0.5	2	0.02	positive
Xanthorrhoea resinifera	2	0.9	2	0.12	positive
Xyris bracteata	2	0.8	1	0.04	positive
Xyris operculata	2	0.5	2	0.01	positive

(c) Cyperoid Heath

❑ *DESCRIPTION*

Cyperoid Heath forms part of the upland swamp complex found on the Woronora Plateau (Keith, 1994). Cyperoid Heath grows on seepage and water discharge sites that are periodically water logged. Species from the Cyperaceae family characterise the dense ground cover that grows up to a metre in height. *Lepidosperma limicola, Gymnoschoenus sphaerocephalus, Chorizandra sphaerocephala* and *Baumea rubiginosa* are frequent and abundant. A number of other species common to Restioid Heath are also consistently recorded within this community. These include *Empodisma minus, Leptocarpus tenax* and *Mitrasacme polymorpha*. *Xyris operculata* and *Selaginella uliginosa* are less frequently observed, though they are characteristic of the assemblage. A low, open shrub layer is present and includes species such as *Banksia robur, Melaleuca squarrosa, Hakea teretifolia*, and *Leptospermum juniperinum*. Small shrubs such as *Pultenaea divaricata* and *Baeckea linifolia* are also found.

This community has been mapped as a Sedgeland-Heath Complex (*sensu.* Keith, 1994). Survey sites describing this community are located at Maddens Plains within the Cataract Catchment although this community extends into Avon and Cordeaux Catchments in less extensive patches. Keith (1994) notes that Cyperoid Heaths are likely to be limited to small areas within Royal, Ku-ring-gai Chase and Brisbane Waters National Parks.

❑ *FLORISTIC SUMMARY*

Number of Sites: 8

Shrubs: 1.5m tall. Mean Projected Canopy Cover 5-35% cover

Banksia robur, Melaleuca squarrosa, Hakea teretifolia, Leptospermum juniperinum, Banksia ericifolia, Pultenaea divaricata, Baeckea linifolia

Sedges and Rushes: up to 1m tall. Mean Projected Canopy Cover 70-90% cover

Lepidosperma limicola, Gymnoschoenus sphaerocephalus, Chorizandra sphaerocephala, Baumea rubiginosa, Empodisma minus, Leptocarpus tenax, Mitrasacme polymorpha, Xyris operculata

❑ *KEY IDENTIFYING FEATURES*

Easily recognisable features to assist in identifying this map unit are

- Large open treeless swamps on the Woronora plateau.
- A dense and dominant cover of sedges from the family Cyperaceae including Button grass (*Gymnoschoenus sphaerocephalus*) and Razor sedge (*Lepidosperma limicola*).
- A low cover of Swamp banksia (*Banksia robur*).

❑ *EXAMPLE LOCATIONS*

Maddens Plains

❑ *DIAGNOSTIC SPECIES*

(Note that Abundance Scores are derived from a 1-6 Braun Blanquet Cover Scale)

Species Name	Group Score	Group Freq	Non Group Score	Non Group Freq	Fidelity Class
Baeckea linifolia	2	0.50	2	0.02	positive
Banksia robur	2	0.67	2	0.01	positive
Baumea rubiginosa	2	0.50	2	0.01	positive
Dampiera stricta	2	0.50	2	0.25	positive
Empodisma minus	3	1.00	2	0.08	positive
Gymnoschoenus sphaerocephalus	4	0.50	2	0.02	positive
Lepidosperma limicola	3	0.83	2	0.01	positive
Leptocarpus tenax	3	1.00	2	0.08	positive
Lepyrodia muelleri	2	0.17	0	0 positiv	e
Mitrasacme polymorpha	2	0.67	2	0.09	positive
Pultenaea divaricata	2	0.50	2	0.01	positive
Selaginella uliginosa	2	0.67	2	0.08	positive
Sprengelia incarnata	2	0.50	2	0.02	positive
Xyris operculata	2	0.67	2	0.01	positive

❑ *CONSERVATION STATUS*

As the three components of Sedgeland-Heath Complex are not mapped separately, the summary statistics for Conservation Status are presented in the table for the one Map Unit.

RESERVATION STATUS

Tenure	Study Area (ha)	Proportion of Total (%)	Sydney Basin Bioregion (ha/%)
National Park Estate	38.05	7.1	41830
Water Catchment	151.49	28.2	3449
State Forest	7.01	1.3	
Wollongong City Council Reserves	0.40	0.1	
Reserved Subtotal	196.95	36.6	
Other	340.79	63.4	
Total	537.74	100	>47000*

*Upland Swamp communities have not been mapped separately outside this report.

CONDITION ASSESSMENT

Disturbance Class	Area (ha)	Proportion Extant (%)
A Light	507.12	94.3
B Moderate	18.69	3.5
C Heavy	11.93	2.2
Scattered trees	0	0
Total	537.74	100

❑ *THREATENED PLANT SPECIES*

None recorded

MU43 Upland Swamps: Fringing Eucalypt Woodland

❑ *DESCRIPTION*

Fringing Eucalypt Woodland has been delineated to highlight the ecotone between the Upland Swamps communities and the surrounding Sandstone Woodlands. The transition between the two can be either abrupt or very gradual. In the case of the latter, a very open woodland with a canopy cover less than ten percent supports widely spaced *Eucalyptus racemosa*, *E. oblonga* or *E. sieberi*. The understorey characteristics are transitional, with some sites sharing greater similarity with the drier components of Restioid Heaths (Map Unit 42b) than Exposed Sandstone Scribbly Gum Woodland (Map Unit 30).

❑ *FLORISTIC SUMMARY*

Number of Sites: 8

Trees: 5-12m tall: Projected Canopy Cover 5-15%

Eucalyptus racemosa/haemastoma/sclerophylla, Eucalyptus oblonga, Eucalyptus sieberi

Shrubs: 1.5m tall. Projected Canopy Cover 15-30% cover

Banksia ericifolia subsp. *ericifolia, Banksia oblongifolia, Hakea dactyloides, Hakea teretifolia*

Sedges and Rushes: up to 1m tall. Projected Canopy Cover 50-70% cover

Leptocarpus tenax, Sprengelia incarnata, Lindsaea linearis, Mitrasacme polymorpha, Empodisma minus

❑ *KEY IDENTIFYING FEATURES*

Easily recognisable features to assist in identifying this map unit are

- Widely spaced Eucalypts marking the transition between sandstone woodland and treeless heath and sedgelands.

❑ *EXAMPLE LOCATIONS*

Maddens Plains; Fire Trail 9 Woronora Catchment.

❑ *CONSERVATION STATUS*

RESERVATION STATUS

Tenure	Study Area (ha)	Proportion of Total (%)	Sydney Basin Bioregion (ha/%)
National Park Estate	1.02	2.2	41830
Water Catchment	5.94	12.7	1580
State Forest	0	0	
Wollongong City Council Reserves	0	0	
Reserved Subtotal	6.96	14.8	
Other	39.92	85.2	
Total	46.88	100	>47000*

*Upland Swamp communities have not been mapped separately outside this report.

CONDITION ASSESSMENT

Disturbance Class	Area (ha)	Proportion Extant (%)
A Light	46.88	100
B Moderate	0	0
C Heavy	0	0
Scattered trees	0	0
Total	46.88	100

❑ *THREATENED PLANT SPECIES*

Epacris purpurascens var. *purpurascens* (V), *Pultenaea aristata* (V), *Darwinia grandiflora* (2R), *Eucalyptus apiculata* (3R)

❑ *DIAGNOSTIC SPECIES*

Species Name	Group Score	Group Freq	Non Group Score	Non Group Freq	Fidelity Class
Actinotus minor	2	0.50	2	0.30	positive
Amphibromus nervosus	3	0.50	0	0.00	positive
Baeckea diosmifolia	2	0.50	2	0.01	positive
Baloskion gracile	3	0.50	2	0.04	positive
Banksia oblongifolia	3	1.00	2	0.23	positive
Banksia spinulosa var. spinulosa	2	1.00	2	0.45	positive
Bossiaea heterophylla	2	0.50	2	0.32	positive
Carex inversa	3	0.50	2	0.02	positive
Cassytha pubescens	2	1.00	1	0.25	positive
Cryptandra ericoides	2	0.50	1	0.01	positive
Dillwynia floribunda	5	0.50	2	0.06	positive
Empodisma minus	2	0.50	2	0.13	positive
Entolasia marginata	2	1.00	2	0.23	positive
Epacris microphylla var. microphylla	2	0.50	2	0.20	positive
Eucalyptus racemosa	2	1.00	2	0.30	positive
Eurychorda complanata	3	0.50	2	0.04	positive
Grevillea oleoides	3	1.00	2	0.24	positive
Hakea dactyloides	3	1.00	2	0.38	positive
Isopogon anemonifolius	2	1.00	2	0.40	positive
Leptocarpus tenax	2	1.00	2	0.14	positive
Leptospermum arachnoides	2	1.00	2	0.18	positive
Leptospermum polygalifolium	2	1.00	2	0.11	positive
Lepyrodia scariosa	4	0.50	2	0.34	positive
Microlaena stipoides var. stipoides	2	0.50	2	0.11	positive
Micromyrtus ciliata	2	0.50	2	0.01	positive
Persoonia lanceolata	2	0.50	1	0.10	positive
Petrophile sessilis	2	0.50	2	0.14	positive
Platysace linearifolia	2	0.50	2	0.39	positive
Poa affinis	2	0.50	2	0.02	positive
Pultenaea aristata	3	0.50	2	0.02	positive
Corymbia gummifera	0	0.00	2	0.52	negative
Entolasia stricta	0	0.00	2	0.54	negative

MU44 Upland Swamps: Mallee-Heath

❑ *DESCRIPTION*

Upland Swamps: Mallee-Heath represents a minor variant to the complex of upland swamp communities. No sample sites have been completed within this map unit and descriptions are borrowed from Benson & Fallding (1985) until further work is completed. A Mallee-Heath community is present on drier gradients with the Upland Swamp Complex in the Avon and Nepean Catchments, and only occasionally in the north near Maddens Plains. *Eucalyptus stricta* occurs in dense clumps amongst a low cover of shrubs such as *Banksia ericifolia* subsp. *ericifolia, B. paludosa* subsp. *paludosa*, *Allocasuarina nana*, *Petrophile sessilis* and *Leptospermum attenuatum*. Ground covers are typical of Restioid Heath, including *Leptocarpus tenax*, *Lepyrodia scariosa* and *Empodisma minus*.

❑ *FLORISTIC SUMMARY*

Number of Sites: 0

Small Trees: 6-10m tall. Mean Projected Canopy Cover 40%

Eucalyptus stricta, Banksia ericifolia subsp. *ericifolia, Hakea teretifolia, Banksia paludosa* subsp. *paludosa, Allocasuarina nana*

Sedges and Rushes: up to 1m tall. Mean Projected Canopy Cover 70-90% cover

Leptocarpus tenax, Lepyrodia scariosa, Empodisma minus, Mitrasacme polymorpha

❑ *KEY IDENTIFYING FEATURES*

Easily recognisable features to assist in identifying this map unit are:

- Emergent Mallee ash (*Eucalyptus stricta)* above a shrub layer of Banksia s, Hakeas and Tea-trees (*Leptospermum* spp.).
- Within broad upland swamp complexes in southern catchments near escarpment edge.

❑ *EXAMPLE LOCATIONS*

Fire Trail 15, Avon Catchment; No 1 Fire Trail at Stockyard Swamp

❑ *CONSERVATION STATUS*

RESERVATION STATUS

Tenure	Study Area (ha)	Proportion of Total (%)	Sydney Basin Bioregion (ha/%)
National Park Estate	0.64	1.1	41830
Water Catchment	24.85	42.3	125
State Forest	0	0	
Wollongong City Council Reserves	0	0	
Reserved Subtotal	25.49	43.4	
Other	31.77	56.6	
Total	57.26	100	>47000*

*Upland Swamp communities have not been mapped separately outside this report.

CONDITION ASSESSMENT

Disturbance Class	Area (ha)	Proportion Extant (%)
A Light	57.26	100
B Moderate	0	0
C Heavy	0	0
Scattered trees	0	0
Total	57.26	100

❑ *THREATENED PLANT SPECIES*

Eucalyptus apiculata (3R)

❑ *DIAGNOSTIC SPECIES*

No Diagnostic Species List available as no survey sites were undertaken in this community.

MU45 Coastal Sand Scrub

❑ *DESCRIPTION*

Coastal Sand Scrub is a low and dense scrub of *Banksia integrifolia* subsp. *integrifolia* and *Leptospermum laevigatum* growing on coastal sand foredunes. Locations are highly exposed to strong, salt laden winds. A number of salt tolerant species are present such as *Acacia longifolia* subsp. *sophorae*, *Monotoca elliptica, Westringia fruticosa* and *Carpobrotus glaucescens*. With increased shelter and deeper soils this community grades into Map Unit 25 Coastal Sand Bangalay-Blackbutt Forest.

Coastal Sand Scrub suffers from chronic infestation by the weed Bitou bush *(Chrysanthemoides monilifera* subsp. *rotundata*). Coastal Sand Scrub has been cleared from many of the beach dunes in the LGA. Relatively recent revegetation programs to restore dune vegetation and stability have reestablished components of this community on some dunal systems.

Coastal Sand Scrubs are a feature of many coastal zones in NSW. There are similar assemblages described by Mills (2000) for Shellharbour LGA and by NPWS (2000a, 2000b) for coastal regions north and south of the Study Area.

❑ *FLORISTIC SUMMARY*

Number of Sites: 1

Small Trees-Tall Shrubs: 5-7m tall. Mean Projected Canopy Cover 60%

Banksia integrifolia subsp. *integrifolia, Leptospermum laevigatum*

Shrubs: 1-2m tall. Mean Projected Canopy Cover 30%

Acacia longifolia var. *sophorae, Correa alba* var. *alba, Monotoca scoparia, Atriplex australasicus, Leucopogon parviflorus, Breynia oblongifolia, Monotoca elliptica, Westringia fruticosa*

Ground Covers: 0-1m tall. Mean Projected Canopy Cover 80%

Lomandra longifolia, Hibbertia scandens, Commelina cyanea, Carpobrotus glaucescens, Pelargonium australe, Dichondra repens, Cynodon dactylon, Isolepis nodosa, Tetragonia tetragonioides

Vines & Climbers:

Cayratia clematidea, Clematis glycinoides

❑ *KEY IDENTIFYING FEATURES*

Easily recognisable features to assist in identifying this map unit are:

- Location on coastal sand foredunes.
- A very low to tall shrubland structure exhibiting windshear with the canopy comprising species such as Coastal wattle (*Acacia longifolia* subsp. *sophorae*), Coast tea-t ree (*Leptospermum laevigatum*) and Coast banksia (*Banksia integrifolia* subsp. *integrifolia*).
- Shrubs such as Coastal correa (*Correa alba* var. *alba*), Coast beard-heath (*Leucopogon parviflorus*) and Tree broom heath (*Monotoca elliptica*).
- High abundance of the weed Bitou bush (*Chrysanthemoides monilifera* var. *rotundata*).
- A ground layer including combinations of the following; Spiny-he aded mat-rush (*Lomandra longifolia*), Pigface (*Carpobrotus glaucescens*), Wild geranium (*Pelargonium australe*), Scurvy weed (*Commelina cyanea*), Couch (*Cynodon dactylon*), Kidney weed (*Dichondra repens*).

❑ *EXAMPLE LOCATIONS*

Puckeys Estate; Bellambi Lagoon; Primbee

❑ *CONSERVATION STATUS*

RESERVATION STATUS

Tenure	Study Area (ha)	Proportion of Total (%)	Sydney Basin Bioregion (ha/%)
National Park Estate	0	0	58 (3)
Water Catchment	0	0	
State Forest	0	0	
Wollongong City Council Reserves	215.03	83.8	
Reserved Subtotal	215.03	83.8	
Other	41.66	16.2	
Total	256.69	100	2041

CONDITION ASSESSMENT

Disturbance Class	Area (ha)	Proportion Extant (%)
A Light	0	0
B Moderate	34.63	13.5
C Heavy	222.06	86.5
Scattered trees	0	0
Total	256.69	100

❑ *THREATENED PLANT SPECIES*

None recorded

❑ *DIAGNOSTIC SPECIES*

Species Name	Group Score	Group Freq	Non Group Score	Non Group Freq	Fidelity Class
Acacia longifolia subsp. sophorae	5	1.00	2	0.03	positive
Banksia integrifolia subsp. integrifolia	5	1.00	4	0.08	positive
Breynia oblongifolia	4	1.00	2	0.38	positive
Carpobrotus glaucescens	2	0.50	1	0.01	positive
Cayratia clematidea	3	1.00	2	0.25	positive
Clerodendrum tomentosum	2	0.50	1	0.42	positive

Species Name	Group Score	Group Freq	Non Group Score	Non Group Freq	Fidelity Class
Commelina cyanea	2	1.00	2	0.32	positive
Correa alba var. alba	3	0.50	0	0.00	positive
Cynodon dactylon	3	0.50	3	0.04	positive
Dichondra repens	2	1.00	3	0.33	positive
Hibbertia scandens	3	1.00	1	0.19	positive
Imperata cylindrica var. major	2	0.50	2	0.15	positive
Leptospermum laevigatum	5	1.00	4	0.03	positive
Leucopogon parviflorus	1	0.50	0	0.00	positive
Lomandra longifolia	3	1.00	2	0.45	positive
Monotoca scoparia	4	0.50	0	0.00	positive
Pelargonium australe	1	0.50	0	0.00	positive
Pittosporum revolutum	2	0.50	1	0.39	positive
Tetragonia tetragonioides	2	0.50	3	0.01	positive
Viola hederacea	2	0.50	2	0.13	positive
Eustrephus latifolius	0	0.00	2	0.68	negative
Geitonoplesium cymosum	1	0.50	2	0.64	negative
Marsdenia rostrata	0	0.00	2	0.58	negative
Notelaea venosa	1	0.50	3	0.57	negative
Oplismenus imbecillis	0	0.00	3	0.59	negative
Pandorea pandorana subsp. pandorana	0	0.00	2	0.65	negative
Pseuderanthemum variabile	0	0.00	3	0.62	negative

MU46 Coastal Headland Banksia Scrub

❑ *DESCRIPTION*

Coastal Headland Banksia Scrub occupies headlands and steep hillslopes directly above sea cliffs north from Austinmer. This community is structurally diverse ranging from a low open shrubland through to a closed shrubland to a low closed forest. These variations are generally in response to the degree of exposure to the south easterly salt laden winds. Common canopy species include *Banksia integrifolia* subsp. *integrifolia*, *Leptospermum laevigatum, Westringia fruticosa, Allocasuarina verticillata* and *Backhousia myrtifolia*. Coastal Headland Banksia Scrub shares a similar floristic composition to Exposed Bangalay-Banksia Woodland and Littoral Windshear Thickets. All three occupy similar habitats and have been differentiated on the basis of the abundance of rainforest species and vegetation structure.

Coastal Headland Banksia Scrub falls into the *Banksia integrifolia-Westringia fruticosa* complex described by Adam *et al.*(1989), which is considered one of the most widespread and extensive vegetation types found on seacliffs. Disturbance from land slippage is common due to the steep and unstable nature of the habitat forming a mosaic of areas at various stages of regrowth. This may give the community a patchy appearance. This map unit is highly susceptible to chronic infestation by the weeds Bitou bush (*Chrysanthemoides monilifera* subsp. *rotundata*) and Mirror bush (*Coprosma repens*).

❑ *FLORISTIC SUMMARY*

Number of Sites: 2

Small Trees-Tall Shrubs: 3-7m tall. Mean Projected Canopy Cover 75%

Banksia integrifolia subsp. *integrifolia, Leptospermum laevigatum, Pittosporum undulatum, Rapanea variabilis, Acmena smithii*

Shrubs: 1-2m tall. Mean Projected Canopy Cover 25%

Westringia fruticosa, Breynia oblongifolia

Ground Covers: 0-1 m tall. Mean Projected Canopy Cover 70%

Lomandra longifolia, Carex appressa, Gahnia melanocarpa, Oplismenus imbecillis, Pseuderanthemum variabile, Viola hederacea, Poa labillardieri var. *labillardieri, Commelina cyanea, Dichondra repens, Hibbertia dentata, Microlaena stipoides* var. *stipoides, Adiantum aethiopicum, Apium prostratum* var. *filiforme, Scaevola calendulacea, Selliera radicans*

Vines & Climbers:

Glycine clandestina, Smilax glyciphylla, Cassytha pubescens, Clematis glycinoides, Geitonoplesium cymosum, Stephania japonica var. *discolor*

❑ *KEY IDENTIFYING FEATURES*

Easily recognisable features to assist in identifying this map unit are:

- Location on coastal headlands, hillslopes and sometimes cliffs.
- A shrubland structure exhibiting windshear, the canopy comprising species such as Coast tea-tree (*Leptospermum laevigatum)* and Coast banksia (*Banksia integrifolia* subsp. *integrifolia*).
- Shrubs such as Coast rosemary (*Westringia fruticosa*).
- The weeds Bitou bush (*Chrysanthemoides monilifera* subsp. *rotundata*) and Mirror bush (*Coprosma repens*).
- A ground layer including some of the following; Spin y-headed mat-rush (*Lomandra longifolia*), Tussock (*Poa labillardieri* var. *labillardieri*), *Oplismenus imbecillis*, Native violet (*Viola hederacea*), Kidney weed (*Dichondra repens*), Twining glycine (*Glycine clandestina*), Tall sedge (*Carex appressa*), Black fruit saw sedge (*Gahnia melanocarpa*), Scurvy weed (*Commelina cyanea*) and Weeping grass (*Microlaena stipoides* var. *stipoides*).

❑ *EXAMPLE LOCATIONS*

Stanwell Park Surf Club; Coalcliff; Wombarra; Scarborough Beach; Clifton

❑ *CONSERVATION STATUS*

RESERVATION STATUS

Tenure	Study Area (ha)	Proportion of Total (%)	Sydney Basin Bioregion (ha/%)
National Park Estate	4.45	8.1	>10 (17)
Water Catchment	0	0	
State Forest	0	0	
Wollongong City Council Reserves	14.78	26.9	
Reserved Subtotal	19.23	35.0	
Other	35.74	65.0	
Total	54.97	100	>60

CONDITION ASSESSMENT

Disturbance Class	Area (ha)	Proportion Extant (%)
A Light	0	0
B Moderate	15.41	28.0
C Heavy	37.56	68.3
Scattered trees	2.0	3.6
Total	54.97	100

❑ *THREATENED PLANT SPECIES*

None recorded

❑ *DIAGNOSTIC SPECIES*

Species Name	Group Score	Group Freq	Non Group Score	Non Group Freq	Fidelity Class
Acacia binervata	3	0.50	3	0.15	positive
Acmena smithii	2	1.00	2	0.45	positive
Adiantum aethiopicum	2	1.00	2	0.10	positive
Backhousia myrtifolia	5	0.50	4	0.13	positive
Banksia integrifolia subsp. integrifolia	6	1.00	4	0.07	positive
Breynia oblongifolia	2	1.00	2	0.38	positive
Carex appressa	3	1.00	1	0.08	positive
Cassytha pubescens	3	0.50	2	0.04	positive
Cayratia clematidea	3	0.50	2	0.25	positive
Clematis glycinoides var. glycinoides	2	0.50	1	0.16	positive
Commelina cyanea	3	0.50	2	0.33	positive
Cupaniopsis anacardioides	1	0.50	0	0.00	positive
Dichondra repens	3	0.50	3	0.34	positive
Gahnia melanocarpa	3	1.00	2	0.11	positive
Glochidion ferdinandi	2	0.50	1	0.12	positive
Glycine clandestina	3	0.50	2	0.24	positive
Goodenia hederacea subsp. hederacea	3	0.50	1	0.04	positive
Hibbertia dentata	3	0.50	2	0.15	positive
Hibbertia scandens	2	0.50	1	0.21	positive
Leptospermum laevigatum	6	1.00	4	0.03	positive
Lomandra longifolia	6	1.00	2	0.46	positive
Microlaena stipoides var. stipoides	3	0.50	2	0.25	positive
Notelaea longifolia forma longifolia	4	0.50	2	0.02	positive
Oplismenus aemulus	3	0.50	2	0.08	positive
Poa labillardieri var. labillardieri	5	0.50	3	0.29	positive
Pteridium esculentum	2	0.50	2	0.18	positive
Pultenaea blakelyi	2	0.50	2	0.02	positive
Rapanea variabilis	2	1.00	2	0.38	positive
Sambucus australasica	2	0.50	1	0.03	positive
Senecio linearifolius	2	1.00	2	0.01	positive
Sigesbeckia orientalis subsp. orientalis	2	0.50	1	0.09	positive
Smilax glyciphylla	3	0.50	2	0.09	positive
Stephania japonica var. discolor	2	1.00	1	0.25	positive
Synoum glandulosum subsp. glandulosum	2	0.50	2	0.39	positive
Tristaniopsis collina	3	0.50	3	0.07	positive
Viola hederacea	3	1.00	2	0.13	positive
Westringia fruticosa	2	1.00	0	0.00	positive
Zieria smithii	3	0.50	2	0.07	positive
Marsdenia rostrata	0	0.00	2	0.57	negative
Notelaea venosa	0	0.00	3	0.58	negative
Pandorea pandorana subsp. pandorana	0	0.00	2	0.65	negative
Eustrephus latifolius	2	0.50	2	0.67	constant
Geitonoplesium cymosum	2	1.00	2	0.63	constant
Oplismenus imbecillis	3	1.00	3	0.58	constant
Pittosporum undulatum	2	1.00	2	0.62	constant
Pseuderanthemum variabile	3	1.00	3	0.60	constant

MU47 Budawang Ash Mallee Scrub

❑ *DESCRIPTION*

Budawang Ash Mallee Scrub occurs directly above clifflines at several disjunct locations along the Illawarra escarpment cliff edge. *Eucalyptus dendromorpha* is the unique feature of a low stunted canopy that rarely grows taller than ten metres. *Eucalyptus dendromorpha* adopts a mallee growth form and shares the canopy with *E. sieberi* and *Syncarpia glomulifera* subsp. *glomulifera*. A dense mesic scrub dominated by *Ceratopetalum apetalum* and *Elaeocarpus reticulatus* occurs in combination with *Melaleuca squarrosa*, *Leptospermum polygalifolium* subsp. *polygalifolium* and *Leucopogon lanceolatus* var. *lanceolatus*. Fern species such as *Calochlaena dubia* and *Sticherus flabellatus* cover the rocky ground.

This community has been identified on the basis of the uniqueness of *Eucalyptus dendromorpha* in the Study Area. Budawang Ash Mallee Scrub shares many species with those occurring within Cliffline Coachwood Scrub (Map Unit 7) and woodlands and forests of the Hawkesbury Sandstone Plateau. Fuller (1980) suggests that *E. dendromorpha* occurs at the crests of escarpment cliffs at Wombarra, Mt. Kembla and Bong Bong Pass and these have been mapped separately. Other patches of this community may occur within Map Unit 7. Fuller & Mills (1985) indicate that a similar vegetation complex is found outside of the Study Area along the edge of the escarpment to at least Kiama.

❑ *FLORISTIC SUMMARY*

Number of Sites: 1

Small Trees: 6-10m tall. Mean Projected Canopy Cover 40%

Eucalyptus dendromorpha, Eucalyptus sieberi, Syncarpia glomulifera subsp. *glomulifera*

Shrubs: 1-4 m tall. Mean Projected Canopy Cover 50%

Ceratopetalum apetalum, Elaeocarpus reticulatus, Schizomeria ovata, Leucopogon lanceolatus var.*lanceolatus, Pultenaea blakelyi, Melaleuca squarrosa, Leptospermum polygalifolium* subsp. *polygalifolium*

Ground Covers: 0.5 m tall. Mean Projected Canopy Cover 85%

Calochlaena dubia, Sticherus flabellatus, Blechnum wattsii, Epacris longiflora, Lomandra longifolia

❑ *KEY IDENTIFYING FEATURES*

Easily recognisable features to assist in identifying this map unit are:

- Location above escarpment cliffs.
- Low stunted mallees of Budawang ash (*Eucalyptus dendromorpha*).
- Dense mesic scrub dominated by low growing Coachwood (*Ceratopetalum apetalum*).
- Dense fern cover (*Sticherus flabellatum, Blechnum* spp., *Calochlaena dubia*) between and across rocks and boulders.

❑ *EXAMPLE LOCATIONS*

Wombarra Clifftops; Mt. Kembla Clifftops

❑ *CONSERVATION STATUS*

RESERVATION STATUS

Tenure	Study Area (ha)	Proportion of Total (%)	Sydney Basin Bioregion (ha/%)
National Park Estate	3.73	35.2	>8 (35)
Water Catchment	0.61	5.8	12 (49)
State Forest	0	0	
Wollongong City Council Reserves	0.06	0.6	
Reserved Subtotal	4.40	41.6	
Other	6.20	58.5	
Total	10.60	100	>25

CONDITION ASSESSMENT

Disturbance Class	Area (ha)	Proportion Extant (%)
A Light	10.60	100
B Moderate	0	0
C Heavy	0	0
Scattered trees	0	0
Total	10.60	100

❑ *THREATENED PLANT SPECIES*

None recorded

❑ *DIAGNOSTIC SPECIES*

Species Name	Group Score	Group Freq	Non Group Score	Non Group Freq	Fidelity Class
Acacia longifolia subsp. longifolia	3	1.00	4	0.04	positive
Billardiera scandens	2	1.00	2	0.11	positive
Blechnum cartilagineum	2	1.00	2	0.20	positive
Blechnum wattsii	3	1.00	3	0.02	positive
Boronia floribunda	2	1.00	0	0.00	positive
Calochlaena dubia	5	1.00	3	0.21	positive
Centella asiatica	2	1.00	2	0.12	positive
Ceratopetalum apetalum	2	1.00	4	0.16	positive
Dianella caerulea	2	1.00	1	0.26	positive
Elaeocarpus reticulatus	4	1.00	1	0.06	positive
Entolasia stricta	3	1.00	3	0.15	positive
Epacris longiflora	3	1.00	2	0.01	positive
Eucalyptus dendromorpha	5	1.00	0	0.00	positive
Eucalyptus sieberi	4	1.00	5	0.02	positive
Gahnia sieberiana	2	1.00	1	0.02	positive
Gonocarpus teucrioides	3	1.00	3	0.05	positive
Goodenia ovata	2	1.00	3	0.03	positive
Hakea salicifolia	2	1.00	4	0.02	positive
Hedycarya angustifolia	2	1.00	1	0.02	positive
Hibbertia dentata	4	1.00	2	0.15	positive
Kennedia rubicunda	2	1.00	1	0.10	positive
Lepidosperma laterale	3	1.00	2	0.15	positive

Species Name	Group Score	Group Freq	Non Group Score	Non Group Freq	Fidelity Class
Leptospermum morrisonii	1	1.00	0	0.00	positive
Leptospermum polygalifolium subsp. polygalifolium	4	1.00	4	0.03	positive
Leucopogon lanceolatus var. lanceolatus	4	1.00	2	0.07	positive
Lomandra longifolia	3	1.00	2	0.46	positive
Melaleuca hypericifolia	1	1.00	0	0.00	positive
Opercularia aspera	4	1.00	1	0.03	positive
Pteridium esculentum	2	1.00	2	0.18	positive
Pultenaea blakelyi	2	1.00	2	0.02	positive
Schizomeria ovata	4	1.00	4	0.09	positive
Smilax glyciphylla	3	1.00	2	0.09	positive
Stephania japonica var. discolor	3	1.00	1	0.26	positive
Sticherus flabellatus var. flabellatus	4	1.00	3	0.01	positive
Themeda australis	2	1.00	3	0.13	positive
Tristaniopsis collina	2	1.00	3	0.07	positive
Eustrephus latifolius	0	0.00	2	0.67	negative
Geitonoplesium cymosum	0	0.00	2	0.64	negative
Marsdenia rostrata	1	1.00	2	0.56	negative
Notelaea venosa	1	1.00	3	0.57	negative
Oplismenus imbecillis	0	0.00	3	0.59	negative
Pandorea pandorana subsp. pandorana	0	0.00	2	0.64	negative
Pittosporum undulatum	1	1.00	2	0.63	negative
Pseuderanthemum variabile	0	0.00	3	0.61	negative

MU48 Rock Pavement Heath

❑ *DESCRIPTION*

Rock Pavement Heath (Keith, 1994) describes an often isolated community that is restricted to large exposed sandstone rock outcrops. These plates, or pavements occur on ridgetops and often feature within a broader complex of exposed rocky knolls, benches and outcrops. The low heath cover may include *Kunzea ambigua*, *Darwinia fascicularis* subsp. *fascicularis*, *Epacris microphylla* var. *microphylla* and *Leptospermum trinervium*. The patchiness of understorey vegetation cover is determined by available moisture present within minor cracks and depression in the rock. Bare rock surfaces comprise a dominant component of the habitat. Low growing *Lepidosperma viscidum*, *Thelionema umbellatum* and *Lepyrodia scariosa* are found amongst the ground cover. Rock pavements and outcrops also appear to provide shelter from intense fire to allow the persistence of *Callitris endlicheri*. This species is fire sensitive (Bell, 1998) and is only found in the Study Area within or adjoining rock outcrops. *Callitris endlicheri* has been recorded in O'Hares, Woronora and Avon Catchments.

Sites used to describe this community are drawn from the O'Hares Creek Catchment (Keith, 1994). However, the distribution of this community is more widespread across isolated favourable patches of habitat between Avon Catchment and Royal National Park. It is also known to occur in Nattai National Park (pers. obs.) and other sandstone reserves such as Ku-ring-gai Chase and Brisbane Waters National Parks and Joadja Nature Reserve.

❑ *FLORISTIC SUMMARY*

Number of Sites: 4

Shrubs: 2-5m tall. Mean Projected Canopy Cover 35%

Kunzea ambigua, Dillwynia fascicularis subsp. *fascicularis, Leptospermum trinervium, Epacris microphylla* var. *microphylla, Banksia ericifolia* subsp. *ericifolia, Monotoca ledifolia, Hakea sericea, Oxylobium cordifolium*

Ground covers: 0.5-1 m tall. Mean Projected Canopy Cover 9%

Lepidosperma viscidum, Thelionema umbellatum, Lepyrodia scariosa, Hypolaena fastigata

❑ *KEY IDENTIFYING FEATURES*

Easily recognisable features to assist in identifying this map unit are:

- Large exposed sandstone rock pavements.
- Low shrub cover of Tick bush (*Kunzea ambigua*) and *Darwinia fascicularis* subsp. *fascicularis.*

❑ *EXAMPLE LOCATIONS*

End of Fire Trail No. 9, Woronora Catchment; North East of Stockyard Swamp on Flat Plateau

❑ *CONSERVATION STATUS*

RESERVATION STATUS

Tenure	Study Area (ha)	Proportion of Total (%)	Sydney Basin Bioregion (ha/%)
National Park Estate	0	0	>4 (5)
Water Catchment	1.76	100	76 (95)
State Forest	0	0	
Wollongong City Council Reserves	0	0	
Reserved Subtotal	1.76	100	
Other	0	0	
Total	1.76	100	>80

CONDITION ASSESSMENT

Disturbance Class	Area (ha)	Proportion Extant (%)
A Light	1.76	100
B Moderate	0	0
C Heavy	0	0
Scattered trees	0	0
Total	1.76	100

❑ *THREATENED PLANT SPECIES*

Monotoca ledifolia (3R)

❑ *DIAGNOSTIC SPECIES*

Species Name	Group Score	Group Freq	Non Group Score	Non Group Freq	Fidelity Class
Callitris endlicheri	4	0.33	0	0.00	positive
Darwinia fascicularis subsp. fascicularis	4	0.67	2	0.04	positive
Epacris microphylla var. microphylla	3	1.00	2	0.20	positive
Kunzea ambigua	5	1.00	1	0.06	positive
Lepidosperma viscidum	4	0.67	1	0.02	positive
Lepyrodia scariosa	4	0.67	2	0.34	positive
Leucopogon microphyllus var. microphyllus	2	0.67	1	0.14	positive
Monotoca ledifolia	3	0.67	2	0.00	positive
Oxylobium cordifolium	1	0.33	0	0.00	positive
Prasophyllum brevilabre	1	0.33	0	0.00	positive
Thelionema umbellatum	2	0.67	1	0.00	positive
Corymbia gummifera	1	0.33	2	0.52	negative
Entolasia stricta	0	0.00	2	0.54	negative

MU49 Rock Plate Heath-Mallee

❑ *DESCRIPTION*

Rock Plate Heath-Mallee occurs across the Study Area on massive sandstone outcrops and rock plates. These vary from sandstone tors that protrude from spiny ridges in the southern Avon Catchment to large open rocks that form broad plates or shelves below the soil surface in the Woronora Catchment. A dense heath is comprised of *Banksia ericifolia* subsp. *ericifolia*, *B. serrata*, *Petrophile pulchella*, *Hakea dactyloides* and *Leptospermum* spp. and is often impenetrable. Mallee eucalypts including *Eucalyptus stricta* and *E. apiculata* are most often found growing alongside or within the heath. North of Appin Road, mallee species may include *E. luehmanniana* and *E. multicaulis*. Very low trees of *Corymbia gummifera*, *E. sclerophylla*, *E. sieberi* and *E. oblonga* are occasionally present. The sprawling herb *Actinotus minor* is consistently part of this assemblage. Other ground covers vary depending on moisture levels of the soil. On rock plates, water seepage is slow resulting in dense covers of rushes and sedges. These include *Lepyrodia scariosa* and *Leptocarpus tenax*. Map Unit 48 Rock Pavement Heath is closely related and is often found within a complex of Rock Plate Heath-Mallee.

Rock Plate Heath-Mallee is a widely distributed community on sandstones of the Bioregion. However, the preferred habitat is restricted to small isolated outcrops, with the total area within the Bioregion relatively small. Map Unit 49 is found in Royal and Morton National Parks, and within the Warragamba Special Areas on the Nattai Plateau and Kings Tableland.

❑ *FLORISTIC SUMMARY*

Number of Sites: 6

Small Trees: 6-10m tall. Mean Projected Canopy Cover 40%

Eucalyptus stricta, Eucalyptus apiculata, Eucalyptus multicaulis, Eucalyptus sclerophylla, Eucalyptus sieberi, Corymbia gummifera, Eucalyptus oblonga

Shrubs: 1-4 m tall. Mean Projected Canopy Cover 50%

Banksia oblongifolia, Banksia ericifolia subsp. *ericifolia, Banksia serrata, Acacia suaveolens, Hakea dactyloides, Angophora hispida, Hakea teretifolia, Petrophile pulchella, Leptospermum polygalifolium* subsp. *polygalifolium, Isopogon anemonifolius, Allocasuarina distyla, Acacia myrtifolia, Lambertia formosa, Grevillea sphacelata, Kunzea capitata, Platysace linearifolia, Darwinia fascicularis* subsp. *fascicularis*

Ground Covers: 0.5 m tall. Mean Projected Canopy Cover 85%

Leptocarpus tenax, Lepyrodia scariosa, Lepidosperma filiforme, Lindsaea linearis, Lomandra obliqua, Patersonia sericea, Cassytha glabella forma *glabella*

❑ *KEY IDENTIFYING FEATURES*

Easily recognisable features to assist in identifying this map unit are:

- Low stunted thin multistemmed trees known as mallees. Typical mallee species include Mallee ash (*E. stricta, E. apiculata*) and Whipstick ash (*E. multicaulis*).
- Ridgetops on Sandstone Rocky outcrops, tors or broad rock plates.
- Dense heath of Banksias and Tea-trees dominated by *Banksia ericifolia* subsp. *ericifolia* and *Leptospermum polygalifolium* subsp. *polygalifolium.*
- Damp to moist ground cover supporting sedges and rush species such as *Lepyrodia scariosa* and *Leptocarpus tenax.*

❑ *EXAMPLE LOCATIONS*

Fire Trail 1, East of Road amongst massive sandstone outcrops.

❑ *CONSERVATION STATUS*

RESERVATION STATUS

Tenure	Study Area (ha)	Proportion of Total (%)	Sydney Basin Bioregion (ha/%)
National Park Estate	0.04	0.1	705 (46)
Water Catchment	68.47	97.3	822 (54)
State Forest	0	0	
Wollongong City Council Reserves	0	0	
Reserved Subtotal	68.51	97.4	
Other	1.80	2.6	
Total	70.31	100	>1530

CONDITION ASSESSMENT

Disturbance Class	Area (ha)	Proportion Extant (%)
A Light	70.31	100
B Moderate	0	0
C Heavy	0	0
Scattered trees	0	0
Total	70.31	100

❑ *THREATENED PLANT SPECIES*

Eucalyptus apiculata (3R)

❑ *DIAGNOSTIC SPECIES*

Species Name	Group Score	Group Freq	Non Group Score	Non Group Freq	Fidelity Class
Allocasuarina distyla	2	0.71	1	0.04	Positive
Angophora hispida	2	0.71	2	0.05	Positive
Banksia ericifolia subsp. ericifolia	4	1.00	2	0.34	Positive
Darwinia fascicularis subsp. fascicularis	2	0.71	2	0.03	Positive
Epacris microphylla var. microphylla	2	0.86	2	0.20	Positive
Guringalia dimorpha	2	0.71	2	0.07	Positive
Hakea dactyloides	2	0.57	2	0.38	Positive
Hakea teretifolia	2	1.00	2	0.22	Positive
Kunzea capitata	2	0.71	2	0.06	Positive
Lepidosperma filiforme	3	0.57	2	0.09	Positive
Leptospermum squarrosum	2	0.71	2	0.10	Positive
Corymbia gummifera	1	0.14	2	0.52	Negative
Entolasia stricta	1	0.14	2	0.54	Negative

MU50 Beach Sands Spinifex

❑ *DESCRIPTION*

Beach Sands Spinifex is a simple vegetation community occurring on coastal sand foredunes. The open grassland is characterised by a single species *Spinifex sericeus*. The harsh, exposed and saline environment restricts the range of species capable of growing in these areas. Other species that may occur include *Carpobrotus glaucescens* and a number of weed species such as *Hydrocotyle bonariensis, Cakile maritima* and *Gazania rigens*. Beach Sands Spinifex is a feature of many foredunes along coastal NSW. The local extent of the grassland cover is largely determined by dune mobility and human disturbance.

❑ *FLORISTIC SUMMARY*

Number of Sites: 1

Ground Covers: 0-0.3m tall. Mean Projected Cover 40%

Spinifex sericeus, Carpobrotus glaucescens

❑ *KEY IDENTIFYING FEATURES*

Easily recognisable features to assist in identifying this map unit are:

- Location on unconsolidated beach sands between high water mark and foredune.
- Open grassland structure with presence of Hairy Spinifex (*Spinifex sericeus*).
- 4WD tracks, sunbaking *Homo sapiens*, Flotsam & Jetsam.

❑ *EXAMPLE LOCATIONS*

Bulli Beach; Stanwell Park; Windang.

❑ *CONSERVATION STATUS*

RESERVATION STATUS

Tenure	Study Area (ha)	Proportion of Total (%)	Sydney Basin Bioegion (ha/%)
National Park Estate	0	0	N/A
Water Catchment	0	0	
State Forest	0	0	
Wollongong City Council Reserves	18.79	74.2	
Reserved Subtotal	18.79	74.2	
Other	6.55	25.8	
Total	25.34	100	N/A

CONDITION ASSESSMENT

This community was not assessed, due to the difficulty in determining disturbance. However, it is likely th at they have been significantly modified from their original condition.

❑ *THREATENED PLANT SPECIES*

None recorded

❑ *DIAGNOSTIC SPECIES*

Species Name	Group Score	Group Freq	Non Group Score	Non Group Freq	Fidelity Class
Spinifex sericeus	5	1	0	0	positive
Eustrephus latifolius	0	0	2	0.67	negative
Geitonoplesium cymosum	0	0	2	0.64	negative
Marsdenia rostrata	0	0	2	0.58	negative
Notelaea venosa	0	0	3	0.58	negative
Oplismenus imbecillis	0	0	3	0.59	negative
Pandorea pandorana subsp. pandorana	0	0	2	0.65	negative
Pittosporum undulatum	0	0	2	0.63	negative
Pseuderanthemum variabile	0	0	3	0.61	negative

MU51 Coastal Headland Grassland

❑ *DESCRIPTION*

Coastal Headland Grassland occupies clay soils on exposed coastal headlands in the north of the LGA. It is a closed grassland comprised of *Lomandra longifolia, Poa labillardieri* var. *labillardieri* and *Themeda australis* with only sparse to isolated shrubs and trees of *Allocasuarina verticillata* and *Banksia integrifolia* subsp. *integrifolia*. Coastal Headland Grasslands occur on steep, unstable ocean facing slopes that are subject to regular erosion events or where original shrub and canopy strata have been removed to create viewpoints.

Adam *et al.* (1989) splits this community into two separate communities, based on the dominance of individual species (*Lomandra longifolia* and *Themeda australis*) both of which are considered extremely widespread. Coastal Headland Grasslands extend into Royal National Park and are prominent at Garie, Burning Palms and Era.

❑ *FLORISTIC SUMMARY*

Number of Sites: 1

Emergent Shrubs: 1-2m tall. Mean Projected Canopy Cover <5%

Allocasuarina verticillata, Banksia integrifolia subsp. *integrifolia*

Ground Covers: 0-0.7m tall. Mean Projected Canopy Cover 100%

Lomandra longifolia, Poa labillardieri var. *labillardieri, Themeda australis, Helichrysum rutidolepis, Adiantum aethiopicum, Desmodium varians, Geranium* spp., *Helichrysum elatum, Hibbertia scandens, Leucopogon juniperinus, Pteridium esculentum, Schoenus apogon, Viola betonicifolia, Viola hederacea, Wahlenbergia gracilis*

Vines & Climbers:

Rubus parviflorus

❑ *KEY IDENTIFYING FEATURES*

Easily recognisable features to assist in identifying this map unit are:

- Location.
- A marked absence of trees and shrubs, with the few individuals present being much reduced in size and often exhibiting windshear.

- The dominance of grass species such as Spiny-headed mat-rush (*Lomandra longifolia*), Tussock *(Poa labillardieri* var. *labillardieri*) and Kangaroo grass (*Themeda australis*).

❑ *EXAMPLE LOCATIONS*

Bald Hill, Stanwell Park; Brickyard Point, Austinmer

❑ *CONSERVATION STATUS*

RESERVATION STATUS

Tenure	Study Area (ha)	Proportion of Total (%)	Sydney Basin Bioregion (ha/%)
National Park Estate	10.44	45.2	In Royal NP
Water Catchment	0	0	
State Forest	0	0	
Wollongong City Council Reserves	5.73	24.8	
Reserved Subtotal	16.17	70.0	
Other	6.92	30.0	
Total	23.09	100	>30

CONDITION ASSESSMENT

Disturbance Class	Area (ha)	Proportion Extant (%)
A Light	5.99	25.9
B Moderate	11.33	49.1
C Heavy	5.77	25.0
Scattered trees	0	0
Total	23.09	100

❑ *THREATENED PLANT SPECIES*

None recorded

❑ *DIAGNOSTIC SPECIES*

Species Name	Group Score	Group Freq	Non Group Score	Non Group Freq	Fidelity Class
Adiantum aethiopicum	2	1.00	2	0.11	positive
Allocasuarina verticillata	1	1.00	0	0.00	positive
Helichrysum rutidolepis	1	1.00	0	0.00	positive
Lomandra longifolia	6	1.00	2	0.46	positive
Poa labillardieri var. labillardieri	5	1.00	3	0.28	positive
Themeda australis	5	1.00	3	0.13	positive
Viola betonicifolia	1	1.00	0	0.00	positive
Eustrephus latifolius	0	0.00	2	0.67	negative
Geitonoplesium cymosum	0	0.00	2	0.64	negative
Marsdenia rostrata	0	0.00	2	0.57	negative
Notelaea venosa	0	0.00	3	0.57	negative
Oplismenus imbecillis	0	0.00	3	0.59	negative
Pandorea pandorana subsp. pandorana	0	0.00	2	0.64	negative
Pittosporum undulatum	0	0.00	2	0.63	negative
Pseuderanthemum variabile	0	0.00	3	0.61	negative

MU52 Saltmarsh

❑ *DESCRIPTION*

Saltmarsh is a feature of t he intertidal zone around the estuaries of Lake Illa warra and estuarine coastal lagoons. Saltmarsh is generally a mosaic of salt tolerant estuarine species, but is most frequently dominated by *Sarcocornia quinqueflora* subsp. *quinqueflora*. T he rush *Juncus kraussii* subsp. *australiensis* and the herbs *Samolus repens* and *Suaeda australis* were recorded within the sites sampled. The mo saic of saltmarsh is low growing and patchy in small areas adjoining mudflats and lake fringes. Saltmarshes grade into Coastal Swamp Oak Forest as salinity levels decrease away from the marsh.

Saltmarshes are likely to have been heavily depleted by urban development (Keith & B edward, 1999), infilling and sedimentation of Lake Illawarra and invasive Mangrove species.

❑ *FLORISTIC SUMMARY*

Number of Sites: 2

Low Tree and Shrub Layer: 8-12m tall. Mean Projected Canopy Cover 10%

Casuarina glauca, Avicennia marina subsp. *australasica*

Low Herb and Sedge Cover: 0-1m tall. Mean Projected Canopy Cover 70%

Sarcocornia quinqueflora subsp. *quinqueflora, Sporobolus virginicus, Triglochin striatum, Juncus kraussii* subsp. *australiensis*

❑ *KEY IDENTIFYING FEATURES*

Easily recognisable features to assist in identifying this map unit are:

- A low mat of sedges and herbs adjoining mudflats, lakes or estuarine lagoons. *Sarcocornia quinqueflora* subsp. *quinqueflora* is the dominant species.
- Adjacent or within stands of Swamp Oak (*Casuarina glauca*) or Mangroves (*Avicennia marina* subsp. *australasica*).

❑ *EXAMPLE LOCATIONS*

Picnic Island; Purry Burry Point; Koona Bay.

❑ *CONSERVATION STATUS*

RESERVATION STATUS

Tenure	Study Area (ha)	Proportion of Total (%)	Sydney Basin Bioregion (ha/%)
National Park Estate	0	0	675 (40)
Water Catchment	0	0	
State Forest	0	0	
Wollongong City Council Reserves	2.80	5.8	
Reserved Subtotal	2.80	5.8	
Other	45.44	94.2	
Total	48.24	100	1677

CONDITION ASSESSMENT

Wetland communities were not assessed, due to the difficulty in determining disturbance. However, it is likely that they have been significantly modified from their original condition.

❑ *THREATENED PLANT SPECIES*

None recorded

❑ *DIAGNOSTIC SPECIES*

Species Name	Group Score	Group Freq	Non Group Score	Non Group Freq	Fidelity Class
Calystegia sepium	3	0.5	2	0.03	positive
Casuarina glauca	6	0.5	3	0.06	positive
Commelina cyanea	3	0.5	2	0.33	positive
Dichondra repens	3	0.5	3	0.34	positive
Enchylaena tomentosa	1	0.5	0	0	positive
Juncus kraussii subsp. australiensis	3	1.0	4	0.02	positive
Microlaena stipoides var. stipoides	3	0.5	2	0.24	positive
Myoporum acuminatum	2	0.5	0	0	positive
Opercularia diphylla	3	0.5	2	0.03	positive
Persicaria decipiens	2	0.5	1	0.01	positive
Phragmites australis	2	0.5	3	0.03	positive
Sarcocornia quinqueflora subsp. quinqueflora	4	1.0	0	0	positive
Sida corrugata	4	0.5	0	0	positive
Suaeda australis	3	1.0	2	0.01	positive
Triglochin striatum	4	0.5	0	0	positive
Eustrephus latifolius	0	0.0	2	0.68	negative
Geitonoplesium cymosum	0	0.0	2	0.64	negative
Marsdenia rostrata	0	0.0	2	0.58	negative
Notelaea venosa	0	0.0	3	0.58	negative
Oplismenus imbecillis	0	0.0	3	0.59	negative
Pandorea pandorana subsp. pandorana	0	0.0	2	0.65	negative
Pittosporum undulatum	1	0.5	2	0.63	negative
Pseuderanthemum variabile	0	0.0	3	0.62	negative

MU53 Estuarine Alluvial Wetland

❑ *DESCRIPTION*

Estuarine Alluvial Wetlands occur in small pockets of low-lying poorly drained soils on the coastal floodplains and estuaries. These wetlands form part of a complex of alluvial vegetation that varies in structure and composition. Few samples have been completed within these wetlands and floristic assemblages are likely to be more varied than those described here. More site-specific detail is available from Chafer (1997). Many of the remnants present in the LGA are highly modified.

Phragmites australis and *Typha orientalis* are common and abundant species adjoining permanent water bodies such as lagoons, ponds and drainage channels. Other combinations of species reflect gradients of saline influence. *Rumex brownii*, *Carex appressa*, *Eleocharis sphacelata*, *Isolepis nodosa*, *Juncus kraussii* subsp. *australiensis*, *Gahnia sieberiana* and *Cladium procerum* have been recorded in the understorey of several of the wetlands. Isolated small trees of *Casuarina glauca* and *Melaleuca styphelioides* occur on drier banks and margins. The understorey shares many species with Coastal Swamp Oak Forest and Alluvial Swamp Mahogany Forest.

Estuarine Alluvial Wetlands form a component of the Sydney Coastal Estuary Swamp Forest Complex, an endangered Ecological Community listed under the Threatened Species Act (1995).

❑ *FLORISTIC SUMMARY*

Number of Sites: ***1***

Low Tree and Shrub Layer: 5-10m tall. Mean Projected Canopy Cover <5%

Casuarina glauca, Melaleuca styphelioides

Low Herb and Sedge Cover: 0-1.5m tall. Mean Projected Canopy Cover 100%

Phragmites australis, Typha orientalis, Rumex brownii, Carex appressa, Eleocharis sphacelata, Isolepis nodosa, Juncus kraussii subsp. *australiense, Gahnia sieberiana, Cladium procerum*

❑ *KEY IDENTIFYING FEATURES*

Easily recognisable features to assist in identifying this map unit are:

- An open swampland on coastal backswamps, floodplains and alluvial depressions.
- Thick cover of rushes such as Common reed (*Phragmites australis)*, Cumbungi rush (*Typha orientalis)*, *Juncus kraussii* subsp. *australiensis* and Tall spike rush (*Eleocharis sphacelata*).
- Low isolated trees of Swamp Oak (*Casuarina glauca*) and Prickly-leaved tea-tree (*Melaleuca styphelioides*).
- Adjacent or within stands of Swamp Oak (*Casuarina glauca*) or Mangroves (*Avicennia marina* subsp. *australasica*).

❑ *EXAMPLE LOCATIONS*

Sandon Point

❑ *CONSERVATION STATUS*

Forms a component of the Sydney Coastal Estuary Swamp Forest Complex, an endangered Ecological Community listed under the Threatened Species Act (1995).

RESERVATION STATUS

Tenure	Study Area (ha)	Proportion of Total (%)	Sydney Basin Bioregion (ha/%)
National Park Estate	0	0	N/A
Water Catchment	0	0	
State Forest	0	0	
Wollongong City Council Reserves	10.68	30.5	
Reserved Subtotal	10.68	30.5	
Other	24.35	69.5	
Total	35.03	100	N/A

CONDITION ASSESSMENT

Wetland communities were not assessed, due to the difficulty in determining disturbance. However, it is likely that they have been significantly modified from their original condition.

❑ *THREATENED PLANT SPECIES*

None recorded

❑ *DIAGNOSTIC SPECIES*

Species Name	Group Score	Group Freq	Non Group Score	Non Group Freq	Fidelity Class
Alternanthera denticulata	3	1	3	0.01	positive
Atriplex australasica	3	1	1	0.03	positive
Commelina cyanea	3	1	2	0.33	positive
Crinum pedunculatum	3	1	0	0.00	positive
Cynodon dactylon	4	1	3	0.04	positive
Isolepis nodosa	4	1	1	0.02	positive
Juncus kraussii subsp. australiensis	5	1	3	0.02	positive
Phragmites australis	5	1	3	0.03	positive
Samolus repens	4	1	1	0.01	positive
Tetragonia tetragonioides	2	1	2	0.02	positive
Eustrephus latifolius	0	0	2	0.67	negative
Geitonoplesium cymosum	0	0	2	0.64	negative
Marsdenia rostrata	0	0	2	0.57	negative

Species Name	Group Score	Group Freq	Non Group Score	Non Group Freq	Fidelity Class
Notelaea venosa	0	0	3	0.57	negative
Oplismenus imbecillis	0	0	3	0.59	negative
Pandorea pandorana subsp. pandorana	0	0	2	0.64	negative
Pittosporum undulatum	0	0	2	0.63	negative
Pseuderanthemum variabile	0	0	3	0.61	negative

MU54 Floodplain Wetland

❑ *DESCRIPTION*

Floodplain Wetlands cover broad depressions on alluvial soils in the Mullet, Macquarie Rivulet and Duck Creek Catchments. Formal sampling of this Map Unit has not been completed for this project. Informal observations have noted that the composition of the wetlands varies between sites. Wetland reeds and rushes present include *Typha orientalis*, *Phragmites australis* and *Eleocharis sphacelata.* These wetlands may well be remnants of once extensive *Melaleuca* or Swamp Oak forests with only patchy swampy soils remaining. The extent of these wetlands will vary depending on the prevailing climate such that areas will reduce during dry periods and expend during the wet. Chafer (1997) notes that these wetlands are poorly described with only the Floodplain Wetlands at Frazers Creek near Albion Park sampled. Based on this site other less dominant species are likely to include *Juncus usitatus, Triglochin procera* and *Ludwigia peploides* subsp. *montevidensis*.

This Map Unit includes small areas of creek swamps and other minor freshwater wetlands. Users should be aware that where brackish influences affect such wetlands, the species found within the Map Unit may relate to the Sydney Estuary Swamp Complex, an Endangered Ecological Community listed under the Threatened Species Act, 1995.

❑ *EXAMPLE LOCATIONS*

Frazers Creek, Albion Park

❑ *CONSERVATION STATUS*

Areas with brackish influences may relate to the Sydney Estuary Swamp Complex, an Endangered Ecological Community listed under the Threatened Species Act, 1995.

RESERVATION STATUS

Tenure	Study Area (ha)	Proportion of Total (%)	Sydney Basin Bioregion (ha/%)
National Park Estate	0	0	648 (16)
Water Catchment	0	0	
State Forest	0	0	
Wollongong City Council Reserves	1.24	1.1	
Reserved Subtotal	1.24	1.1	
Other	110.38	98.9	
Total	111.62	100	>4069

CONDITION ASSESSMENT

Wetland communities were not assessed, due to the difficulty in determining disturbance. However, it is likely that they have been significantly modified from their original condition.

❑ *THREATENED PLANT SPECIES*

None recorded

MU55a Estuarine Seagrass-Mudflats

- ***DESCRIPTION***

Seagrass Meadows can be found on shallow subtidal sediments in estuarine environments in and around Lake Illawarra and other coastal lagoons. Formal sampling of this map unit has not been attempted. The dominant species of these habitats is likely to vary, although *Zostera capricorni* is common in Lake Illawarra (Chafer, 1997). Other species known to occur include *Posidonia australis* and *Ruppia polycarpa.* This unit has been mapped as a complex with shallow mudflats and depositional zones in the coastal lake system.

Area: 790.52 (Ha)

MU55b Offshore Mixed Reef

- ***DESCRIPTION***

Aerial Photo Interpretation recognised distinct patterns growing on submerged rock platforms that extend into the ocean from several protruding headlands north of Wollongong. These areas are dominated by the possibly introduced green alga *Caulerpa filiformis*. Other species present are the green alga *Ulva lactuca*, the brown algae *Zonaria* spp., *Sargassum* spp. and *Dilophus marginata* and the red algae *Amphiroa* spp., *Delisea pulchra, Corallina officianalis, Gracilaria* spp., *Laurencia* spp. and *Champia compressa* (L. Miller, pers. comm.). Other types of vegetation, particularly Kelp Forests, occur in subtidal areas of the Illawarra coast, such as off the Five Islands. These have not been mapped as they are not identifiable from the API.

Area: 98.75 (Ha)

MU56 Disturbed Landscapes

❑ *MU56(A) ACACIA SCRUBS*

Area: 1227.95 (ha)

A number of *Acacia* species (*A. mearnsii, A. maidenii, A. binervata, A. melanoxylon*) recolonise cleared or heavily disturbed native vegetation. These Acacias often form dense scrubs on a wide variety of regenerating habitats and environments. *Acacia mearnsii* scrubs are distinctive on the footslopes of the escarpment, where tall moist forests and rainforests are likely to have once existed. In disturbed rainforest, *Acacia melanoxylon* may form a tall dense canopy. On the plateau on shale soils, *Acacia binervata* occasionally forms a tall closed shrub to small tree layer in areas formerly burnt, cleared or underscrubbed. Acacia Scrubs regularly occur in combination with weeds such as *Lantana camara*. However, they also occur in combination with native species such as *Syncarpia glomulifera* subsp. *glomulifera* and species common to remnant rainforest and wet sclerophyll forest. The Aerial Photo Interpretation data can help users to identify other vegetation that is occurring with the Acacia scrubs on a site by site basis.

❑ *MU56(B) REGENERATING TURPENTINE*

Area: 92.59 (ha)

Dense, monospecific stands of regrowth Turpentine (*Syncarpia glomulifera* subsp. *glomulifera*) occur on the Narrabeen Shales of the Woronora Plateau, and occasionally on benches and slopes of the escarpment below. These areas are likely to be indicative of past clearing. The prolific growth of Turpentine tends to exclude light from the forest floor resulting in a highly simplified version of the surrounding sclerophyll forests. Weeds and exotics are not prolific although Crofton Weed (*Ageratina adenophora*) is regularly present in low abundance amongst a sparse ground cover of Bracken (*Pteridium esculentum*) and Spiny-headed mat-rush (*Lomandra longifolia*).

❑ *MU56(C) ALLOCASUARINA HEATH REGENERATION*

Appendix B: Sites by Strata Table In drier habitats on shale soils, Black sheoak (*Allocasuarina littoralis)* tends to rapidly recolonise disturbed areas. Within the Study Area, a single small patch occurs above the escarpment just north of Mt. Burrell.

❑ *MU56(D) WEEDS AND EXOTICS*

Area: 1645.61 (ha)

Infestation by weeds and other exotic species is common on the Illawarra Escarpment and Coastal Plain. Lantana (*Lantana camara*) is the most conspicuous of these species, often forming scrambling impenetrable scrubs. These areas are prominent on former grazing and mining sites on escarpment benches and gullies. Weeds and exotics have been mapped as a feature where they dominate and as a disturbance descriptor where they occur in combination with native vegetation communities. Roadside plantations have been included in this map unit. Remnant vegetation along riparian strips are often a combination of Willow Trees (*Salix* spp.), Coral Trees (*Erythrina X sykesii*) and isolated native species.

❑ *MU56(E) CLEARED LAND*

Area: 17497.83 (ha)

Removal of native vegetation cover for agricultural, urban and industrial land uses is widespread across the LGA. The Aerial Photo Interpretation data can be used to differentiate these land uses if required.

❑ *MU56(F) MODIFIED LANDS*

Area: 421.15 (ha)

Modified Lands includes areas that have had substantial alteration from their original topographic sequence. Types of modifications include landfill, quarries, coal emplacements, artificial water bodies and mine tunnels. Aerial Photo Interpretation Data can be used to distinguish these features. In some cases regenerating vegetation may be growing on modified lands. This has been identified where possible.

Appendix B: Sites by Strata Table

Strata Unit Soil landscape x aspect	Soil Landscape Name	Pre 1750 area (ha)	% Landscape pre-1750	Extant Area (ha)	No. of Sites achieved in survey	Ideal apportioning of 191 sites based on Pre 1750 area	Existing sites	Total No. of sites	Sampling Deficiency
apF	albion park	1622.9	2.06	**33.6**	**2**	3.9	0	2	2
bkE	berkely	465.1	0.59	**101.1**	**0**	1.1	1	1	
bkF		20.4	0.03	**3.4**	**0**	0.0	0	0	
bkN		346.6	0.44	**94.4**	**1**	0.8	2	3	
bkS		379.6	0.48	**83.1**	**2**	0.9	4	6	
bkW		274.4	0.35	**87.3**	**0**	0.7	0	0	1
boE	bombo	816.6	1.04	**23.8**	**0**	2.0	1	1	1
boF		16.3	0.02	**0.2**	**0**	0.0	0	0	
boN		674.4	0.86	**10.8**	**0**	1.6	0	0	2
boS		596.1	0.76	**54.6**	**0**	1.4	0	0	1
boW		462.6	0.59	**23.6**	**0**	1.1	0	0	1
btF	blacktown	128.3	0.16	**45.6**	**0**	0.3	0	0	
buE	bundeena	1758.0	2.24	**1568.1**	**0**	4.3	13	13	
buF		44.6	0.06	**37.4**	**0**	0.1	0	0	
buN		1962.3	2.50	**1808.7**	**0**	4.8	23	23	
buS		840.5	1.07	**704.5**	**0**	2.0	8	8	
buW		1026.5	1.31	**955.9**	**0**	2.5	15	15	
caE	cambewarra	1467.1	1.87	**259.9**	**5**	3.6	0	5	
caF		24.3	0.03	**4.6**	**0**	0.1	0	0	
caN		1429.6	1.82	**340.4**	**3**	3.5	0	3	
caS		978.6	1.24	**331.7**	**6**	2.4	0	6	
caW		528.2	0.67	**175.8**	**0**	1.3	0	0	1
creek		396.1	0.50	**9.0**	**1**	1.0	0	1	
faF	fairy meadow	5612.0	7.14	**154.2**	**9**	13.6	1	10	4
fbF	faulconbridge	266.6	0.34	**265.7**	**1**	0.6	0	1	
foF	fountaindale	114.9	0.15	**3.4**	**0**	0.3	0	0	
gwE	gwyneville	1791.2	2.28	**97.5**	**5**	4.4	2	7	
gwF		112.8	0.14	**0.4**	**0**	0.3	0	0	
gwN		924.4	1.18	**22.6**	**0**	2.2	0	0	2
gwS		1880.4	2.39	**132.6**	**11**	4.6	0	11	
gwW		776.5	0.99	**47.5**	**3**	1.9	0	3	
gyE	gymea	128.7	0.16	**98.9**	**0**	0.3	0	0	
gyF		4.6	0.01	**3.6**	**0**	0.0	0	0	
gyN		136.9	0.17	**116.9**	**0**	0.3	1	1	

Strata Unit Soil landscape x aspect	Soil Landscape Name	Pre 1750 area (ha)	% Landscape pre-1750	Extant Area (ha)	No. of Sites achieved in survey	Ideal apportioning of 191 sites based on Pre 1750 area	Existing sites	Total No. of sites	Sampling Deficiency
gyS		161.2	0.21	**133.9**	**0**	0.4	2	2	
gyW		71.8	0.09	**68.1**	**0**	0.2	1	1	
haE	hawkesbury	4299.6	5.47	**4014.0**	**1**	10.4	16	17	
haF		97.4	0.12	**86.5**	**0**	0.2	0	0	
haN		4805.9	6.11	**4608.7**	**3**	11.7	27	30	
haS		3093.1	3.93	**3015.2**	**2**	7.5	12	14	
haW		3651.8	4.65	**3560.8**	**0**	8.9	16	16	
ieE	Illawarra escarpment	2333.2	2.97	**877.3**	**23**	5.7	0	23	
ieF		8.6	0.01	**2.4**	**0**	0.0	0	0	
ieN		313.6	0.40	**106.9**	**4**	0.8	0	4	
ieS		3054.0	3.88	**1946.1**	**35**	7.4	0	35	
ieW		427.3	0.54	**287.3**	**10**	1.0	0	10	
kiF	killalea	305.8	0.39	**2.1**	**0**	0.7	0	0	1
knF	Kurnell	142.1	0.18	**9.5**	**1**	0.3	0	1	
lhE	Lucas heights	1437.3	1.83	**1372.3**	**1**	3.5	6	7	
lhF		32.1	0.04	**30.6**	**0**	0.1	0	0	
lhN		1789.4	2.28	**1733.7**	**0**	4.3	15	15	
lhS		1194.9	1.52	**1158.6**	**0**	2.9	8	8	
lhW		1639.3	2.09	**1575.8**	**0**	4.0	8	8	
mcF	mangrove creek	211.8	0.27		**0**	0.5	0	0	1
mdE	maddens plains	1378.6	1.75	**1291.1**	**0**	3.3	12	12	
mdF		47.8	0.06	**44.3**	**0**	0.1	0	0	
mdN		1549.3	1.97	**1460.9**	**0**	3.8	10	10	
mdS		936.1	1.19	**873.1**	**1**	2.3	6	7	
mdW		1112.8	1.42	**997.8**	**0**	2.7	4	4	
roF	roberston	26.7	0.03	**26.6**	**3**	0.1	0	3	
shF	shellharbour	3663.1	4.66	**101.5**	**11**	8.9	0	11	
smF	seven mile	353.1	0.45	**57.0**	**9**	0.9	0	9	
wbE	warragamba	1484.1	1.89	**1305.0**	**2**	3.6	3	5	
wbF		45.9	0.06	**35.1**	**0**	0.1	2	2	
wbN		1521.8	1.94	**1354.2**	**3**	3.7	11	14	
wbS		1266.6	1.61	**1167.9**	**0**	3.1	10	10	
wbW		1501.0	1.91	**1356.3**	**2**	3.6	11	13	

Strata Unit Soil landscape x aspect	Soil Landscape Name	Pre 1750 area (ha)	% Landscape pre-1750	Extant Area (ha)	No. of Sites achieved in survey	Ideal apportioning of 191 sites based on Pre 1750 area	Existing sites	Total No. of sites	Sampling Deficiency
wgE	wollongong	186.0	0.24	**71.3**	**2**	0.5	1	3	
wgF		9.6	0.01		**0**	0.0	0	0	
wgN		26.8	0.03	**7.8**	**1**	0.1	2	3	
wgS		107.0	0.14	**56.5**	**1**	0.3	0	1	
wgW		23.4	0.03	**8.1**	**0**	0.1	0	0	
wmF	wianamatta	200.8	0.26	**199.6**	**0**	0.5	1	1	
wnE	watagan	664.9	0.85	**580.7**	**1**	1.6	6	7	
wnF		19.9	0.03	**19.3**	**0**	0.0	0	0	
wnN		523.3	0.67	**487.7**	**2**	1.3	5	7	
wnS		809.0	1.03	**716.4**	**11**	2.0	3	14	
wnW		407.4	0.52	**387.1**	**0**	1.0	1	1	
wtE	wattamloa road	550.6	0.70	**9.1**	**1**	1.3	0	1	
wtF		4.7	0.01		**0**	0.0	0	0	
wtN		408.7	0.52	**1.8**	**3**	1.0	0	3	
wtS		645.3	0.82	**44.0**	**3**	1.6	0	3	
wtW		248.8	0.32	**19.5**	**2**	0.6	0	2	
yaF	yarrawarrah	10.4	0.01	**10.4**	**0**	0.0	0	0	
50m buffer		1802.1	2.29	**35.75**	**4**	4.4	0	4	
Total		**78613.3**	**100**	**44904.9**	**187**	**191.0**	**270**	**457**	

Appendix C: Flora Species Recorded During Illawarra Vegetation Surveys

Family	Scientific Name	Common Name	Int.
Acanthaceae	*Brunoniella australis*	Blue Trumpet	
Acanthaceae	*Pseuderanthemum variabile*	Pastel Flower	
Adiantaceae	*Adiantum aethiopicum*	Common Maidenhair	
Adiantaceae	*Adiantum diaphanum*	Filmy Maidenhair	
Adiantaceae	*Adiantum formosum*	Giant Maidenhair	
Adiantaceae	*Adiantum hispidulum* var. *hispidulum*	Rough Maidenhair	
Adiantaceae	*Adiantum silvaticum*		
Adiantaceae	*Cheilanthes sieberi* subsp. *sieberi*		
Adiantaceae	*Pellaea falcata*	Sickle Fern	
Adiantaceae	*Pellaea nana*	Dwarf Sickle Fern	
Aizoaceae	*Tetragonia tetragonioides*	New Zealand Spinach	
Amaranthaceae	*Alternanthera denticulata*	Lesser Joyweed	
Amaranthaceae	*Nyssanthes diffusa*	Barbwire Weed	
Amaryllidaceae	*Crinum pedunculatum*	Swamp Lily	
Anacardiaceae	*Euroschinus falcata* var. *falcata*	Ribbonwood	
Anthericaceae	*Arthropodium milleflorum*	Vanilla Lily	
Anthericaceae	*Arthropodium species B*		
Anthericaceae	*Chlorophytum comosum*		*
Anthericaceae	*Dichopogon strictus*	Chocolate Lily	
Anthericaceae	*Laxmannia gracilis*		
Anthericaceae	*Tricoryne elatior*	Yellow Autumn-lily	
Apiaceae	*Actinotus minor*	Lesser Flannel Flower	
Apiaceae	*Apium prostratum*	Sea Celery	
Apiaceae	*Centella asiatica*	Pennywort	
Apiaceae	*Hydrocotyle bonariensis*		*
Apiaceae	*Hydrocotyle laxiflora*	Stinking Pennywort	
Apiaceae	*Hydrocotyle peduncularis*		
Apiaceae	*Hydrocotyle tripartita*	Pennywort	
Apiaceae	*Platysace lanceolata*		
Apiaceae	*Platysace linearifolia*		
Apiaceae	*Trachymene anisocarpa*		
Apiaceae	*Xanthosia pilosa*		
Apiaceae	*Xanthosia tridentata*		
Apocynaceae	*Melodinus australis*	Southern Melodinus	
Apocynaceae	*Parsonsia straminea*	Common Silkpod	
Araceae	*Alocasia brisbanensis*	Cunjevoi	

Family	Scientific Name	Common Name	Int.
Araceae	*Gymnostachys anceps*	Settler's Flax	
Araceae	*Zantedeschia aethiopica*	Arum Lily	*
Araliaceae	*Astrotricha latifolia*		
Araliaceae	*Cephalaralia cephalobotrys*	Climbing Panax	
Araliaceae	*Polyscias elegans*	Celery Wood	
Araliaceae	*Polyscias murrayi*	Pencil Cedar	
Araliaceae	*Polyscias sambucifolia*	Elderberry Panax	
Arecaceae	*Archontophoenix cunninghamiana*	Bangalow Palm	
Arecaceae	*Livistona australis*	Cabbage Palm	
Asclepiadaceae	*Araujia sericifera*	Moth Plant	*
Asclepiadaceae	*Cynanchum elegans*		
Asclepiadaceae	*Gomphocarpus fruticosus*	Narrow-leaved Cotton Bush	*
Asclepiadaceae	*Marsdenia flavescens*	Hairy Milk Vine	
Asclepiadaceae	*Marsdenia rostrata*	Common Milk Vine	
Asclepiadaceae	*Tylophora barbata*	Bearded Tylophora	
Asparagaceae	*Myrsiphyllum asparagoides*	Florist's Smilax	*
Asparagaceae	*Protasparagus aethiopicus*	Sprengeri Fern	*
Asparagaceae	*Protasparagus plumosus*	Climbing Asparagus Fern	*
Aspleniaceae	*Asplenium australasicum* forma *australasicum*	Bird's Nest Fern	
Aspleniaceae	*Asplenium flabellifolium*	Necklace Fern	
Asteraceae	*Ageratina adenophora*	Crofton Weed	*
Asteraceae	*Ageratina riparia*	Mistflower	*
Asteraceae	*Aster subulatus*	Wild Aster	*
Asteraceae	*Baccharis halimifolia*	Groundsel Bush	*
Asteraceae	*Bidens pilosa*	Cobbler's Pegs	*
Asteraceae	*Brachyscome angustifolia* var. *angustifolia*		
Asteraceae	*Bracteantha bracteata*	Golden Everlasting	
Asteraceae	*Cassinia cunninghamii*		
Asteraceae	*Cassinia denticulata*		
Asteraceae	*Cassinia longifolia*		
Asteraceae	*Cassinia trinerva*		
Asteraceae	*Chrysanthemoides monilifera* subsp. *monilifera*	Boneseed	*
Asteraceae	*Chrysanthemoides monilifera* subsp. *rotundata*	Bitou Bush	*
Asteraceae	*Cirsium vulgare*	Spear Thistle	*
Asteraceae	*Conyza albida*	Tall Fleabane	*
Asteraceae	*Conyza bonariensis*	Flaxleaf Fleabane	*
Asteraceae	*Delairea odorata*	Cape Ivy	*
Asteraceae	*Erigeron karvinskianus*	Bony-tip Fleabane	*

Family	Scientific Name	Common Name	Int.
Asteraceae	*Euchiton involucratus*	Star Cudweed	
Asteraceae	*Euchiton sphaericus*		
Asteraceae	*Helichrysum elatum*		
Asteraceae	*Hypochaeris radicata*	Catsear	*
Asteraceae	*Lagenifera stipitata*	Blue Bottle-daisy	
Asteraceae	*Olearia argophylla*	Native Musk	
Asteraceae	*Olearia viscidula*	Wallaby Weed	
Asteraceae	*Ozothamnus diosmifolius*	White Dogwood	
Asteraceae	*Senecio hispidulus* var. *hispidulus*		
Asteraceae	*Senecio linearifolius*		
Asteraceae	*Senecio madagascariensis*	Fireweed	*
Asteraceae	*Sigesbeckia orientalis* subsp. *orientalis*	Indian Weed	
Asteraceae	*Sonchus oleraceus*	Common Sowthistle	*
Asteraceae	*Stuartina muelleri*	Spoon Cudweed	
Asteraceae	*Tagetes minuta*	Stinking Roger	*
Asteraceae	*Taraxacum officinale*	Dandelion	*
Asteraceae	*Vernonia cinerea* var. *cinerea*		
Azollaceae	*Azolla pinnata*		
Basellaceae	*Anredera cordifolia*	Madeira Vine	*
Bignoniaceae	*Jacaranda mimosifolia*	Jacaranda	*
Bignoniaceae	*Pandorea pandorana* subsp. *pandorana*		
Blechnaceae	*Blechnum cartilagineum*	Gristle Fern	
Blechnaceae	*Blechnum patersonii* subsp. *patersonii*	Strap Water Fern	
Blechnaceae	*Blechnum wattsii*	Hard Water Fern	
Blechnaceae	*Doodia aspera*	Prickly Rasp Fern	
Blechnaceae	*Doodia australis*	Common Rasp Fern	
Blechnaceae	*Doodia caudata*		
Boraginaceae	*Ehretia acuminata* var. *acuminata*	Koda	
Brassicaceae	*Rorippa microphylla*	One-rowed Watercress	*
Cactaceae	*Opuntia stricta*		*
Campanulaceae	*Wahlenbergia communis*	Tufted Bluebell	
Campanulaceae	*Wahlenbergia gracilis*	Australian Bluebell	
Cannaceae	*Canna indica*	Indian Shot	*
Caprifoliaceae	*Lonicera japonica*	Japanese Honeysuckle	*
Caryophyllaceae	*Stellaria flaccida*		
Casuarinaceae	*Allocasuarina littoralis*	Black Sheoak	
Casuarinaceae	*Allocasuarina torulosa*	Forest Oak	
Casuarinaceae	*Casuarina glauca*	Swamp Oak	

Family	Scientific Name	Common Name	Int.
Celastraceae	*Cassine australis* var. *australis*	Red Olive-berry	
Celastraceae	*Celastrus australis*	Staff VIne	
Celastraceae	*Celastrus subspicata*		
Chenopodiaceae	*Atriplex australasica*		
Chenopodiaceae	*Einadia hastata*	Berry Saltbush	
Chenopodiaceae	*Sarcocornia quinqueflora* subsp. *quinqueflora*		
Clusiaceae	*Hypericum gramineum*	Small St John's Wort	
Commelinaceae	*Aneilema acuminatum*		
Commelinaceae	*Aneilema biflorum*		
Commelinaceae	*Commelina cyanea*	Native Wandering Jew	
Commelinaceae	*Pollia crispata*		
Commelinaceae	*Tradescantia fluminensis*	Wandering Jew	*
Convolvulaceae	*Calystegia marginata*		
Convolvulaceae	*Calystegia sepium*		
Convolvulaceae	*Convolvulus arvensis*		*
Convolvulaceae	*Dichondra repens*	Kidney Weed	
Convolvulaceae	*Ipomoea cairica*		*
Convolvulaceae	*Ipomoea indica*	Blue Morning Glory	*
Convolvulaceae	*Polymeria calycina*		
Cunoniaceae	*Aphanopetalum resinosum*	Gum Vine	
Cunoniaceae	*Callicoma serratifolia*	Black Wattle	
Cunoniaceae	*Ceratopetalum apetalum*	Coachwood	
Cunoniaceae	*Schizomeria ovata*	Crabapple	
Cyatheaceae	*Cyathea australis*	Rough Treefern	
Cyatheaceae	*Cyathea leichhardtiana*	Prickly Treefern	
Cyperaceae	*Carex appressa*		
Cyperaceae	*Carex brunnea*		
Cyperaceae	*Carex inversa*	Knob Sedge	
Cyperaceae	*Carex longebrachiata*	Bergalia Tussock	
Cyperaceae	*Caustis flexuosa*	Curly Wig	
Cyperaceae	*Cladium procerum*		
Cyperaceae	*Cyperus brevifolius*		*
Cyperaceae	*Cyperus eragrostis*	Umbrella Sedge	*
Cyperaceae	*Cyperus gracilis*		
Cyperaceae	*Cyperus imbecillis*		
Cyperaceae	*Cyperus laevis*		
Cyperaceae	*Cyperus tenellus*		*
Cyperaceae	*Cyperus tetraphyllus*		

Family	Scientific Name	Common Name	Int.
Cyperaceae	*Fimbristylis dichotoma*		
Cyperaceae	*Gahnia aspera*		
Cyperaceae	*Gahnia clarkei*		
Cyperaceae	*Gahnia melanocarpa*		
Cyperaceae	*Gahnia sieberiana*		
Cyperaceae	*Isolepis nodosa*	Knobby Club-rush	
Cyperaceae	*Lepidosperma filiforme*		
Cyperaceae	*Lepidosperma laterale*		
Cyperaceae	*Schoenus apogon*	Fluke Bogrush	
Cyperaceae	*Schoenus melanostachys*		
Davalliaceae	*Arthropteris beckleri*		
Davalliaceae	*Arthropteris tenella*		
Davalliaceae	*Davallia solida* var. *pyxidata*	Hare's Foot Fern	
Davalliaceae	*Nephrolepis cordifolia*	Fishbone Fern	
Dennstaedtiaceae	*Dennstaedtia davallioides*	Lacy Ground Fern	
Dennstaedtiaceae	*Hypolepis muelleri*	Harsh Ground Fern	
Dennstaedtiaceae	*Pteridium esculentum*	Bracken	
Dicksoniaceae	*Calochlaena dubia*	Common Ground Fern	
Dicksoniaceae	*Dicksonia antarctica*	Soft Treefern	
Dilleniaceae	*Hibbertia aspera*		
Dilleniaceae	*Hibbertia dentata*	Twining Guinea Flower	
Dilleniaceae	*Hibbertia empetrifolia* subsp. *empetrifolia*		
Dilleniaceae	*Hibbertia obtusifolia*		
Dilleniaceae	*Hibbertia scandens*	Climbing Guinea Flower	
Droseraceae	*Drosera auriculata*		
Dryopteridaceae	*Lastreopsis acuminata*	Shiny Shield Fern	
Dryopteridaceae	*Lastreopsis decomposita*	Trim Shield Fern	
Dryopteridaceae	*Lastreopsis microsora* subsp. *microsora*	Creeping Shield Fern	
Dryopteridaceae	*Polystichum australiense*	Harsh Shield Fern	
Ebenaceae	*Diospyros australis*	Black Plum	
Ebenaceae	*Diospyros pentamera*	Myrtle Ebony	
Elaeocarpaceae	*Elaeocarpus kirtonii*	Silver Quandong	
Elaeocarpaceae	*Elaeocarpus reticulatus*	Blueberry Ash	
Epacridaceae	*Epacris pulchella*		
Epacridaceae	*Leucopogon juniperinus*		
Epacridaceae	*Leucopogon lanceolatus* var. *lanceolatus*		
Epacridaceae	*Leucopogon parviflorus*	Coastal Beard-heath	
Epacridaceae	*Monotoca elliptica*		

Family	Scientific Name	Common Name	Int.
Epacridaceae	*Trochocarpa laurina*	Tree Heath	
Escalloniaceae	*Abrophyllum ornans*	Native Hydrangea	
Escalloniaceae	*Polyosma cunninghamii*	Featherwood	
Euphorbiaceae	*Actephila lindleyi*		
Euphorbiaceae	*Alchornea ilicifolia*	Native Holly	
Euphorbiaceae	*Amperea xiphoclada*		
Euphorbiaceae	*Baloghia inophylla*	Brush Bloodwood	
Euphorbiaceae	*Breynia oblongifolia*	Coffee Bush	
Euphorbiaceae	*Claoxylon australe*	Brittlewood	
Euphorbiaceae	*Croton verreauxii*	Native Cascarilla	
Euphorbiaceae	*Euphorbia marginata*	Snow-on-the-Mountains	*
Euphorbiaceae	*Glochidion ferdinandi*	Cheese Tree	
Euphorbiaceae	*Glochidion ferdinandi* var. *ferdinandi*	Cheese Tree	
Euphorbiaceae	*Mallotus philippensis*	Red Kamala	
Euphorbiaceae	*Omalanthus populifolius*	Bleeding Heart	
Euphorbiaceae	*Phyllanthus gunnii*		
Euphorbiaceae	*Poranthera microphylla*		
Euphorbiaceae	*Ricinocarpos pinifolius*	Wedding Bush	
Eupomatiaceae	*Eupomatia laurina*	Bolwarra	
Fabaceae (Caesalpinioideae)	*Senna pendula* var. *glabrata*		*
Fabaceae (Caesalpinioideae)	*Senna septemtrionalis*	Arsenic Bush	*
Fabaceae (Faboideae)	*Aotus ericoides*		
Fabaceae (Faboideae)	*Bossiaea heterophylla*		
Fabaceae (Faboideae)	*Chorizema parviflorum*	Eastern Flame Pea	
Fabaceae (Faboideae)	*Daviesia genistifolia*	Broom Bitter Pea	
Fabaceae (Faboideae)	*Daviesia ulicifolia*	Gorse Bitter Pea	
Fabaceae (Faboideae)	*Desmodium brachypodum*	Large Tick-trefoil	
Fabaceae (Faboideae)	*Desmodium rhytidophyllum*		
Fabaceae (Faboideae)	*Desmodium varians*	Slender Tick-trefoil	
Fabaceae (Faboideae)	*Dillwynia floribunda*		
Fabaceae (Faboideae)	*Glycine clandestina*		
Fabaceae (Faboideae)	*Glycine microphylla*		
Fabaceae (Faboideae)	*Glycine tabacina*		
Fabaceae (Faboideae)	*Hardenbergia violacea*	False Sarsaparilla	
Fabaceae (Faboideae)	*Hovea linearis*		
Fabaceae (Faboideae)	*Indigofera australis*		
Fabaceae (Faboideae)	*Jacksonia scoparia*	Dogwood	
Fabaceae (Faboideae)	*Kennedia rubicunda*	Red Kennedy Pea	

Family	Scientific Name	Common Name	Int.
Fabaceae (Faboideae)	*Podolobium ilicifolium*	Prickly Shaggy Pea	
Fabaceae (Faboideae)	*Pultenaea blakelyi*		
Fabaceae (Faboideae)	*Pultenaea daphnoides*		
Fabaceae (Faboideae)	*Pultenaea flexilis*		
Fabaceae (Faboideae)	*Pultenaea linophylla*		
Fabaceae (Faboideae)	*Pultenaea retusa*		
Fabaceae (Faboideae)	*Pultenaea villosa*		
Fabaceae (Faboideae)	*Vicia sativa*		*
Fabaceae (Mimosoideae)	*Acacia binervata*	Two-veined Hickory	
Fabaceae (Mimosoideae)	*Acacia binervia*	Coast Myall	
Fabaceae (Mimosoideae)	*Acacia elata*	Mountain Cedar Wattle	
Fabaceae (Mimosoideae)	*Acacia falcata*		
Fabaceae (Mimosoideae)	*Acacia implexa*	Hickory Wattle	
Fabaceae (Mimosoideae)	*Acacia longifolia* subsp. *longifolia*	Sydney Golden Wattle	
Fabaceae (Mimosoideae)	*Acacia longifolia* subsp. *sophorae*	Coastal Wattle	
Fabaceae (Mimosoideae)	*Acacia maidenii*	Maiden's Wattle	
Fabaceae (Mimosoideae)	*Acacia mearnsii*	Black Wattle	
Fabaceae (Mimosoideae)	*Acacia melanoxylon*	Blackwood	
Fabaceae (Mimosoideae)	*Acacia suaveolens*	Sweet Wattle	
Fabaceae (Mimosoideae)	*Acacia terminalis*	Sunshine Wattle	
Fabaceae (Mimosoideae)	*Acacia ulicifolia*	Prickly Moses	
Fabaceae (Mimosoideae)	*Pararchidendron pruinosum* var. *pruinosum*	Snow Wood	
Flacourtiaceae	*Scolopia braunii*	Flintwood	
Geraniaceae	*Geranium homeanum*		
Geraniaceae	*Geranium solanderi* var. *solanderi*	Native Geranium	
Gesneriaceae	*Fieldia australis*		
Gleicheniaceae	*Gleichenia dicarpa*		
Goodeniaceae	*Dampiera stricta*		
Goodeniaceae	*Goodenia bellidifolia* subsp. *bellidifolia*		
Goodeniaceae	*Goodenia hederacea* subsp. *hederacea*		
Goodeniaceae	*Goodenia ovata*		
Goodeniaceae	*Selliera radicans*		
Haloragaceae	*Gonocarpus micranthus*		
Haloragaceae	*Gonocarpus tetragynus*		
Haloragaceae	*Gonocarpus teucrioides*		
Hypoxidaceae	*Hypoxis hygrometrica*	Golden Weather-grass	
Icacinaceae	*Citronella moorei*	Chumwood	
Icacinaceae	*Pennantia cunninghamii*	Brown Beech	

Family	Scientific Name	Common Name	Int.
Iridaceae	*Patersonia glabrata*		
Juncaceae	*Juncus kraussii* subsp. *australiensis*	Sea Rush	
Juncaceae	*Juncus usitatus*		
Juncaginaceae	*Triglochin striatum*	Streaked Arrowgrass	
Lamiaceae	*Plectranthus parviflorus*		
Lamiaceae	*Prunella vulgaris*	Self-heal	*
Lamiaceae	*Westringia fruticosa*	Coastal Rosemary	
Lauraceae	*Cassytha glabella form glabella*		
Lauraceae	*Cassytha pubescens*		
Lauraceae	*Cinnamomum camphora*	Camphor Laurel	*
Lauraceae	*Cryptocarya glaucescens*	Jackwood	
Lauraceae	*Cryptocarya microneura*	Murrogun	
Lauraceae	*Endiandra sieberi*	Hard Corkwood	
Lauraceae	*Litsea reticulata*	Bolly Gum	
Lauraceae	*Neolitsea dealbata*	White Bolly Gum	
Liliaceae	*Lilium formosanum*		*
Lindsaeaceae	*Lindsaea linearis*	Screw Fern	
Lobeliaceae	*Pratia purpurascens*	Whiteroot	
Lomandraceae	*Lomandra brevis*		
Lomandraceae	*Lomandra confertifolia* subsp. *rubiginosa*		
Lomandraceae	*Lomandra filiformis*	Wattle Matt-rush	
Lomandraceae	*Lomandra glauca*	Pale Mat-rush	
Lomandraceae	*Lomandra longifolia*	Spiny-headed Mat-rush	
Lomandraceae	*Lomandra multiflora* subsp. *multiflora*	Many-flowered Mat-rush	
Lomandraceae	*Lomandra obliqua*		
Loranthaceae	*Amyema congener* subsp. *congener*		
Loranthaceae	*Amyema gaudichaudii*		
Luzuriagaceae	*Eustrephus latifolius*	Wombat Berry	
Luzuriagaceae	*Geitonoplesium cymosum*	Scrambling Lily	
Malaceae	*Cotoneaster pannosus*		*
Malaceae	*Pyracantha angustifolia*		*
Malvaceae	*Abutilon oxycarpum*	Flannel Weed	
Malvaceae	*Hibiscus heterophyllus* subsp. *heterophyllus*	Native Rosella	
Malvaceae	*Lagunaria patersonia* subsp. *bracteatus*	Norfolk Island Hibiscus	
Malvaceae	*Sida corrugata*		
Malvaceae	*Sida rhombifolia*	Paddy's Lucerne	*
Meliaceae	*Melia azedarach*	White Cedar	
Meliaceae	*Synoum glandulosum* subsp. *glandulosum*	Scentless Rosewood	

Family	Scientific Name	Common Name	Int.
Meliaceae	*Toona ciliata*	Red Cedar	
Menispermaceae	*Legnephora moorei*	Round-leaf Vine	
Menispermaceae	*Sarcopetalum harveyanum*	Pearl Vine	
Menispermaceae	*Stephania japonica* var. *discolor*	Snake Vine	
Monimiaceae	*Doryphora sassafras*	Sassafras	
Monimiaceae	*Hedycarya angustifolia*	Native Mulberry	
Monimiaceae	*Palmeria scandens*	Anchor Vine	
Monimiaceae	*Wilkiea huegeliana*	Veiny Wilkiea	
Moraceae	*Ficus coronata*	Creek Sandpaper Fig	
Moraceae	*Ficus macrophylla* subsp. *macrophylla*		
Moraceae	*Ficus obliqua* var. *obliqua*		
Moraceae	*Ficus rubiginosa*	Port Jackson Fig, Rusty Fig	
Moraceae	*Ficus superba* var. *henneana*	Deciduous Fig	
Moraceae	*Maclura cochinchinensis*	Cockspur Thorn	
Moraceae	*Morus alba*	White Mulberry	*
Moraceae	*Streblus brunonianus*	Whalebone Tree	
Moraceae	*Trophis scandens* subsp. *scandens*	Burny Vine	
Myoporaceae	*Myoporum acuminatum*		
Myrsinaceae	*Rapanea howittiana*	Brush Muttonwood	
Myrsinaceae	*Rapanea variabilis*	Muttonwood	
Myrtaceae	*Acmena smithii*	Lilly Pilly	
Myrtaceae	*Angophora floribunda*	Rough-barked Apple	
Myrtaceae	*Austromyrtus acmenoides*	Scrub Ironwood	
Myrtaceae	*Backhousia myrtifolia*	Grey Myrtle	
Myrtaceae	*Callistemon salignus*	Willow Bottlebrush	
Myrtaceae	*Corymbia gummifera*	Red Bloodwood	
Myrtaceae	*Corymbia maculata*		
Myrtaceae	*Eucalyptus bosistoana*	Coast Grey Gum	
Myrtaceae	*Eucalyptus botryoides*	Bangalay	
Myrtaceae	*Eucalyptus cypellocarpa*	Monkey Gum	
Myrtaceae	*Eucalyptus elata*	River Peppermint	
Myrtaceae	*Eucalyptus eugenioides*	Thin-leaved Stringybark	
Myrtaceae	*Eucalyptus globoidea*	White Stringybark	
Myrtaceae	*Eucalyptus longifolia*	Woollybutt	
Myrtaceae	*Eucalyptus muelleriana*	Yellow Stringybark	
Myrtaceae	*Eucalyptus paniculata* subsp. *paniculata*	Grey Ironbark	
Myrtaceae	*Eucalyptus pilularis*	Blackbutt	
Myrtaceae	*Eucalyptus piperita*	Sydney Peppermint	

Family	Scientific Name	Common Name	Int.
Myrtaceae	*Eucalyptus punctata*	Grey Gum	
Myrtaceae	*Eucalyptus quadrangulata*	White-topped Box	
Myrtaceae	*Eucalyptus robusta*	Swamp Mahogany	
Myrtaceae	*Eucalyptus saligna X botryoides*		
Myrtaceae	*Eucalyptus sieberi*	Silvertop Ash	
Myrtaceae	*Eucalyptus smithii*	Ironbark Peppermint	
Myrtaceae	*Eucalyptus tereticornis*	Forest Red Gum	
Myrtaceae	*Leptospermum laevigatum*	Coast Teatree	
Myrtaceae	*Leptospermum polygalifolium*		
Myrtaceae	*Leptospermum polygalifolium* subsp. *polygalifolium*		
Myrtaceae	*Leptospermum trinervium*		
Myrtaceae	*Melaleuca decora*		
Myrtaceae	*Melaleuca ericifolia*		
Myrtaceae	*Melaleuca linariifolia*		
Myrtaceae	*Melaleuca styphelioides*	Prickly-leaved Tea Tree	
Myrtaceae	*Rhodamnia rubescens*	Scrub Turpentine	
Myrtaceae	*Syncarpia glomulifera* subsp. *glomulifera*		
Myrtaceae	*Syzygium australe*	Brush Cherry	
Myrtaceae	*Syzygium oleosum*	Blue Lilly Pilly	
Myrtaceae	*Tristaniopsis collina*	Mountain Water Gum	
Myrtaceae	*Tristaniopsis laurina*	Kanuka	
Nyctaginaceae	*Pisonia umbellifera*	Birdlime Tree	
Ochnaceae	*Ochna serrulata*	Mickey Mouse Plant	*
Oleaceae	*Ligustrum lucidum*	Large-leaved Privet	*
Oleaceae	*Ligustrum sinense*	Small-leaved Privet	*
Oleaceae	*Notelaea longifolia*	Large Mock-olive	
Oleaceae	*Notelaea venosa*	Veined Mock-olive	
Oleaceae	*Olea europaea* subsp. *cuspidata*		*
Ophioglossaceae	*Botrychium australe*	Parsley Fern	
Orchidaceae	*Dendrobium pugioniforme*	Dagger Orchid	
Orchidaceae	*Plectorrhiza tridentata*	Tangle Orchid	
Orchidaceae	*Sarcochilus olivaceus*		
Oxalidaceae	*Oxalis chnoodes*		
Oxalidaceae	*Oxalis exilis*		
Oxalidaceae	*Oxalis perennans*		
Passifloraceae	*Passiflora edulis*	Common Passionfruit	*
Passifloraceae	*Passiflora subpeltata*	White Passionflower	*
Peperomiaceae	*Peperomia blanda* var. *floribunda*		

Family	Scientific Name	Common Name	Int.
Phormiaceae	*Dianella caerulea*		
Phormiaceae	*Dianella caerulea* var. *assera*		
Phormiaceae	*Dianella caerulea* var. *caerulea*		
Phormiaceae	*Dianella caerulea* var. *producta*		
Phormiaceae	*Dianella longifolia*		
Phormiaceae	*Dianella longifolia* var. *longifolia*		
Phormiaceae	*Dianella revoluta* var. *revoluta*		
Phytolaccaceae	*Phytolacca octandra*	Inkweed	*
Piperaceae	*Piper novae-hollandiae*	Giant Pepper Vine	
Pittosporaceae	*Billardiera scandens*	Appleberry	
Pittosporaceae	*Billardiera scandens* var. *scandens*		
Pittosporaceae	*Bursaria spinosa*	Native Blackthorn	
Pittosporaceae	*Pittosporum multiflorum*	Orange Thorn	
Pittosporaceae	*Pittosporum revolutum*	Rough Fruit Pittosporum	
Pittosporaceae	*Pittosporum undulatum*	Sweet Pittosporum	
Plantaginaceae	*Plantago gaudichaudii*		
Plantaginaceae	*Plantago lanceolata*	Lamb's Tongues	*
Poaceae	*Austrodanthonia caespitosa*	Ringed Wallaby Grass	
Poaceae	*Austrodanthonia pilosa*	Smooth-flowered Wallaby Grass	
Poaceae	*Austrodanthonia racemosa* var. *racemosa*		
Poaceae	*Austrodanthonia tenuior*		
Poaceae	*Austrostipa ramosissima*	Stout Bamboo Grass	
Poaceae	*Avena barbata*	Bearded Oats	*
Poaceae	*Axonopus fissifolius*	Narrow-leaved Carpet Grass	*
Poaceae	*Bothriochloa biloba*		
Poaceae	*Bothriochloa decipiens*	Red Grass	
Poaceae	*Briza subaristata*		*
Poaceae	*Bromus catharticus*		*
Poaceae	*Bromus racemosus*	Smooth Brome	*
Poaceae	*Cenchrus caliculatus*	Hillside Burrgrass	
Poaceae	*Chloris divaricata* var. *divaricata*	Slender Chloris	
Poaceae	*Chloris gayana*	Rhodes Grass	*
Poaceae	*Chloris ventricosa*	Tall Chloris	
Poaceae	*Cymbopogon refractus*	Barbed Wire Grass	
Poaceae	*Cynodon dactylon*	Common Couch	
Poaceae	*Dichelachne micrantha*	Shorthair Plumegrass	
Poaceae	*Dichelachne rara*		
Poaceae	*Digitaria diffusa*		

Family	Scientific Name	Common Name	Int.
Poaceae	*Digitaria parviflora*	Small-flowered Finger Grass	
Poaceae	*Digitaria ramularis*		
Poaceae	*Echinopogon caespitosus* var. *caespitosus*	Tufted Hedgehog Grass	
Poaceae	*Echinopogon ovatus*	Forest Hedgehog Grass	
Poaceae	*Ehrharta erecta*	Panic Veldtgrass	*
Poaceae	*Entolasia marginata*	Bordered Panic	
Poaceae	*Entolasia stricta*	Wiry Panic	
Poaceae	*Eragrostis brownii*	Brown's Lovegrass	
Poaceae	*Eragrostis leptostachya*	Paddock Lovegrass	
Poaceae	*Imperata cylindrica* var. *major*	Blady Grass	
Poaceae	*Microlaena stipoides* var. *stipoides*		
Poaceae	*Oplismenus aemulus*		
Poaceae	*Oplismenus imbecillis*		
Poaceae	*Panicum pygmaeum*	Pygmy Panic	
Poaceae	*Panicum simile*	Two-colour Panic	
Poaceae	*Paspalidium distans*		
Poaceae	*Paspalum dilatatum*	Paspalum	*
Poaceae	*Paspalum distichum*	Water Couch	
Poaceae	*Paspalum urvillei*	Vasey Grass	*
Poaceae	*Pennisetum clandestinum*	Kikuyu Grass	*
Poaceae	*Phragmites australis*	Common Reed	
Poaceae	*Poa labillardierei* var. *labillardierei*	Tussock	
Poaceae	*Setaria gracilis*	Slender Pigeon Grass	*
Poaceae	*Sporobolus africanus*	Parramatta Grass	*
Poaceae	*Sporobolus creber*	Slender Rat's Tail Grass	
Poaceae	*Sporobolus elongatus*	Slender Rat's Tail Grass	
Poaceae	*Sporobolus virginicus*		
Poaceae	*Stenotaphrum secundatum*	Buffalo Grass	*
Poaceae	*Themeda australis*	Kangaroo Grass	
Poaceae	*Zoysia macrantha*	Prickly Couch	
Podocarpaceae	*Podocarpus elatus*	Plum Pine	
Polygonaceae	*Acetosa sagittata*	Rambling Dock	*
Polygonaceae	*Persicaria decipiens*	Slender Knotweed	
Polygonaceae	*Rumex brownii*	Swamp Dock	
Polygonaceae	*Rumex crispus*	Curled Dock	*
Polypodiaceae	*Microsorum pustulatum* subsp. *pustulatum*	Kangaroo Fern	
Polypodiaceae	*Microsorum scandens*	Fragrant Fern	
Polypodiaceae	*Platycerium bifurcatum*	Elkhorn	

Family	Scientific Name	Common Name	Int.
Polypodiaceae	*Pyrrosia rupestris*	Rock Felt Fern	
Primulaceae	*Anagallis arvensis*	Scarlet/Blue Pimpernel	*
Primulaceae	*Samolus repens*	Creeping Brookweed	
Proteaceae	*Banksia integrifolia* subsp. *integrifolia*		
Proteaceae	*Banksia marginata*		
Proteaceae	*Banksia serrata*		
Proteaceae	*Banksia spinulosa* var. *spinulosa*		
Proteaceae	*Hakea dactyloides*		
Proteaceae	*Hakea salicifolia*	Willow-leaved Hakea	
Proteaceae	*Hakea sericea*		
Proteaceae	*Isopogon anemonifolius*		
Proteaceae	*Lambertia formosa*	Mountain Devil	
Proteaceae	*Lomatia silaifolia*	Crinkle Bush	
Proteaceae	*Persoonia levis*	Broad-leaved Geebung	
Proteaceae	*Persoonia linearis*	Narrow-leaved Geebung	
Proteaceae	*Stenocarpus salignus*	Scrub Beefwood	
Proteaceae	*Telopea speciosissima*	Waratah	
Pteridaceae	*Pteris tremula*	Tender Brake	
Pteridaceae	*Pteris umbrosa*	Jungle Brake	
Ranunculaceae	*Clematis aristata*		
Ranunculaceae	*Clematis glycinoides* var. *glycinoides*	Headache Vine	
Ranunculaceae	*Ranunculus lappaceus*	Common Buttercup	
Restionaceae	*Empodisma minus*		
Restionaceae	*Lepyrodia scariosa*		
Rhamnaceae	*Alphitonia excelsa*	Red Ash	
Rhamnaceae	*Emmenosperma alphitonioides*	Yellow Ash	
Rhamnaceae	*Pomaderris andromedifolia*		
Ripogonaceae	*Ripogonum album*	White Supplejack	
Rosaceae	*Rubus fruticosus*	Blackberry complex	*
Rosaceae	*Rubus molluccanus* var. *trilobus*	Molucca Bramble	
Rosaceae	*Rubus nebulosus*	Green-leaved Bramble	
Rosaceae	*Rubus parvifolius*	Native Raspberry	
Rosaceae	*Rubus rosifolius*	Rose-leaf Bramble	
Rubiaceae	*Canthium coprosmoides*	Coast Canthium	
Rubiaceae	*Coprosma quadrifida*	Prickly Currant Bush	
Rubiaceae	*Galium binifolium*		
Rubiaceae	*Galium propinquum*	Maori Bedstraw	
Rubiaceae	*Morinda jasminoides*		

Family	Scientific Name	Common Name	Int.
Rubiaceae	*Opercularia aspera*	Coarse Stinkweed	
Rubiaceae	*Opercularia diphylla*		
Rubiaceae	*Opercularia hispida*	Hairy Stinkweed	
Rubiaceae	*Psychotria loniceroides*	Hairy Psychotria	
Rubiaceae	*Richardia stellaris*		*
Rutaceae	*Acronychia oblongifolia*	Common Acronychia	
Rutaceae	*Citrus x taitensis*	Rough Lemon	*
Rutaceae	*Correa alba* var. *alba*	White Correa	
Rutaceae	*Geijera salicifolia* var. *latifolia*	Brush Wilga	
Rutaceae	*Melicope micrococca*	Hairy-leaved Doughwood	
Rutaceae	*Sarcomelicope simplicifolia* subsp. *simplicifolia*	Big Yellow Wood	
Rutaceae	*Zieria smithii*	Sandfly Zieria	
Sambucaceae	*Sambucus australasica*	Native Elderberry	
Santalaceae	*Exocarpos cupressiformis*	Native Cherry	
Santalaceae	*Exocarpos strictus*	Dwarf Cherry	
Santalaceae	*Leptomeria acida*	Sour Currant Bush	
Sapindaceae	*Alectryon subcinereus*	Wild Quince	
Sapindaceae	*Cupaniopsis anacardioides*	Tuckeroo	
Sapindaceae	*Diploglottis australis*	Native Tamarind	
Sapindaceae	*Dodonaea triquetra*		
Sapindaceae	*Dodonaea viscosa* subsp. *angustifolia*		
Sapindaceae	*Guioa semiglauca*		
Sapotaceae	*Planchonella australis*	Black Apple	
Scrophulariaceae	*Veronica plebeia*	Trailing Speedwell	
Selaginellaceae	*Selaginella uliginosa*		
Smilacaceae	*Smilax australis*	Sarsaparilla	
Smilacaceae	*Smilax glyciphylla*	Sweet Sarsparilla	
Solanaceae	*Cestrum parqui*	Green Cestrum	*
Solanaceae	*Duboisia myoporoides*	Corkwood	
Solanaceae	*Physalis peruviana*	Cape Gooseberry	*
Solanaceae	*Solanum chenopodioides*	Whitetip Nightshade	*
Solanaceae	*Solanum mauritianum*	Wild Tobacco Bush	*
Solanaceae	*Solanum nigrum*	Black-berry Nightshade	*
Solanaceae	*Solanum prinophyllum*	Forest Nightshade	
Solanaceae	*Solanum pseudocapsicum*	Madeira Winter Cherry	*
Solanaceae	*Solanum stelligerum*	Devil's Needles	
Sterculiaceae	*Brachychiton acerifolius*	Illawarra Flame Tree	
Sterculiaceae	*Brachychiton populneus*	Kurrajong	

Family	Scientific Name	Common Name	Int.
Sterculiaceae	*Commersonia fraseri*	Brush Kurrajong	
Stylidiaceae	*Stylidium graminifolium*	Grass Triggerplant	
Symplocaceae	*Symplocos thwaitesii*	Buff Hazelwood	
Thelypteridaceae	*Christella dentata*		
Thymelaeaceae	*Pimelea ligustrina*		
Thymelaeaceae	*Pimelea ligustrina* subsp. *hypericina*		
Thymelaeaceae	*Pimelea linifolia*		
Typhaceae	*Typha orientalis*	Broad-leaved Cumbungi	
Ulmaceae	*Celtis occidentalis*	Hackberry	*
Ulmaceae	*Celtis paniculata*	Native Celtis	
Ulmaceae	*Celtis sinensis*	Chinese Nettle Tree	*
Ulmaceae	*Trema tomentosa* var. *viridis*	Native Peach	
Urticaceae	*Dendrocnide excelsa*	Giant Stinging Tree	
Urticaceae	*Elatostema reticulatum*		
Urticaceae	*Urtica incisa*	Stinging Nettle	
Uvulariaceae	*Schelhammera undulata*		
Verbenaceae	*Clerodendrum tomentosum*		
Verbenaceae	*Lantana camara*	Lantana	*
Verbenaceae	*Verbena bonariensis*	Purpletop	*
Verbenaceae	*Verbena officinalis*	Common Verbena	*
Verbenaceae	*Verbena rigida*	Veined Verbena	*
Violaceae	*Hymenanthera dentata*	Tree Violet	
Violaceae	*Viola hederacea*	Ivy-leaved Violet	
Vitaceae	*Cayratia clematidea*	Slender Grape	
Vitaceae	*Cissus antarctica*	Water Vine	
Vitaceae	*Cissus hypoglauca*	Giant Water Vine	
Winteraceae	*Tasmannia insipida*	Brush Pepperwood	
Xanthorrhoeaceae	*Xanthorrhoea resinifera*		
Xyridaceae	*Xyris complanata*		
Zingiberaceae	*Alpinia caerulea*	Native Ginger	
Zingiberaceae	*Hedychium gardnerianum*	Ginger Lily	*

Appendix D: API Codes

PRIMARY CODE	DESCRIPTION	DOMINANTS	
E1	WHITE TOPPED BOX FOREST	*Eucalyptus quadrangulata*	
E10	SCRIBBLY GUM – SILVERTOP ASH WOODLAND	*Eucalyptus racemosa, E. sieberi*	Low open woodland confined to shallow soils on the Hawkesbury sandstone geologies with a sandstone heath understorey. Usually attached to treeless heaths. Generally with a eucalypt cover of 5 to 20% ccpd
E10a	SCRIBBLY GUM WOODLAND	*Eucalyptus racemosa*	Low open woodland confined to shallow soils on the Hawkesbury sandstone geologies with a sandstone heath understorey. Usually attached to treeless heaths. Generally with a eucalypt cover of 5 to 20% ccpd
E12	RED GUM FOOTHILL FOREST	*Eucalyptus tereticornis, E. bosistoana, E. quadrangulata*	
E13	BLUE GUM TALL FOREST	*Eucalyptus saligna/botryoides*	
E13a	BLUE GUM TALL FOREST	*Eucalyptus saligna*	
E15	BLACKBUTT FOREST	*Eucalyptus pilularis, Syncarpia glomulifera*	
E15a	GREY IRONBARK - BLACKBUTT FOREST	*Eucalyptus paniculata, E. pilularis*	
E15b	TURPENTINE - GREY IRONBARK FOREST	*Syncarpia glomulifera, Eucalyptus paniculata*	
E15c	BLACKBUTT ANGOPHORA FOREST	*Eucalyptus pilularis, Angophora costata*	
E16	MIXED TALL MOUNTAIN FOREST	*Eucalyptus smithii, E. elata, E. saligna, E. quadrangulata, E. globoidea, E. cypellocarpa, E. muelleriana, E. sieberi. E. piperita*	
E16a	GULLY GUM TALL FOREST	*Eucalyptus smithii*	
E16b	YELLOW STRINGYBARK TALL FOREST	*Eucalyptus muelleriana*	
E16c	RIVER PEPPERMINT TALL FOREST	*Eucalyptus elata*	
E16d	MIXED TALL MOUNTAIN FOREST WITH BLUE GUM	*Eucalyptus smithii, E. elata, E. saligna, E. quadrangulata, E. globoidea, E. cypellocarpa, E. muelleriana, E. sieberi. E. piperita*	
E16e	MESSMATE – GREY GUM – NARROW-LEAVED PEPPERMINT FOREST	*Eucalyptus piperata, E. obliqua, E. cypellocarpa, E. radiata*	
E17	PLATEAU MALLEE HEATH	*Eucalyptus apiculata, E. ligustrina*	***E. sieberi, E. gummifera, E. racemosa***
E17a	BUDAWANG ASH FOREST	*Eucalyptus dendromorpha*	Can grow in tree form along the edge of the cliff face and around wet heath environments - class ‘E17a/L7’ separated from the shorter mallee form class ‘E17/X’

PRIMARY CODE	DESCRIPTION	DOMINANTS		
E20	SILVERTOP ASH FOREST	*Eucalyptus sieberi*	*E. piperita, Corymbia gummifera*	Taller Silvertop Ash Forest with a shrubby rather than a sandstone heath understore Separated from the Sandstone Silvertop Ash by its Understorey attribute – 'E20/C' rather than 'E20/X'
E21	SYDNEY PEPPERMINT - SILVERTOP ASH FOREST	*Eucalyptus piperita, E. sieberi*	*Corymbia gummifera, E. racemosa*	Sandstone slopes and ridge where Sydney Peppermint and Silvertop Ash intermix. Eucalypt tree cover is generally >50% ccpd
E21a	SYDNEY PEPPERMINT - SILVERTOP ASH – SYDNEY BLUE GUM FOREST	*Eucalyptus piperita, E. sieberi, E. saligna, E. saligna/botryoides*		
E22	SYDNEY PEPPERMINT TALL FOREST	*Eucalyptus piperita*		
E23	SANDSTONE PLATEAU WOODLAND	*Eucalyptus sieberi, Corymbia gummifera, E. racemosa, E. globoidea*		
E23c	SANDSTONE PLATEAU WOODLAND with ANGOPHORA	*As above with Angophora costata*		
E24	ANGOPHORA SYDNEY PEPPERMINT FOREST	*Angophora costata, Eucalyptus piperita*		
E3	WET SWAMP MAHOGANY WOODLAND	*Eucalyptus robusta, Sedges*		
E30	SPOTTED GUM FOREST	*Corymbia maculata*		
E32	BROWN BARREL TALL FOREST	*Eucalyptus smithii, E. fastigata*		
E34	SWAMP GUM WOODLAND	*E. ovata*		
E5	COASTAL BANGALAY OPEN WOODLAND	*Eucalyptus botryoides, Banksia integrifolia*		
E5b	COASTAL BLACKBUTT WOODLAND	*Corymbia gummifera, Eucalyptus pilularis, E. botryoides*		
E6	YALLA REDGUM – WOOLYBUTT FOREST	*Eucalyptus tereticornis, E. longifolia, Angophora floribunda*	*E. eugenioides, E. bosistoana, E. amplifolia, E. botryoides, Melaleuca decora, M. styphelioides, Acacia falcate, A. mearnsii*	Occupying relatively flat landscapes now above the floodplain. Possibly 'old' floodplains now dissected (cut through) with *Melaleuca* formi a dominant upper understorey Ground flora is composed of grasses and shrubs. Patches *Melaleuca* without eucalypt cover can occur.

PRIMARY CODE	DESCRIPTION	DOMINANTS		
E6a	COASTAL GREY IRONBARK MIXED FOREST	*Eucalyptus paniculata, E. longifolia, E. tereticornis*	*E. pilularis, E. eugenioides, E. saligna/botryoides, Melaleuca decora, M. styphelioides*	Occupying relatively flat landscapes with a lateritic soil profile. Virtually all lost. Probably once with a *Melaleu* upper understorey with a ground flora of grasses and shrubs becoming mesic along creeklines
7E6b	YALLA REDGUM – BLACKBUTT FOREST	*Eucalyptus pilularis, E. longifolia, E. eugenioides*	***E. tereticornis, Melaleuca decora, M. styphelioides***	
E6c	BERKELEY HILLS RED GUM FOREST	*Eucalyptus tereticornis, Angophora floribunda*	*E. bosistoana, E. longifolia, E. eugenioides*	Occupying the Berkeley Hills Latite (Basalt) geologies. Mostly a grassy understorey becoming mesic in the upper gullies and transforming into Dry Rainforest on the steeper scree slopes
E7	ALLUVIAL BANGALAY FOREST	*E. botryoides*		Alluvial Forest at Wollingurry Point
E8	RED GUM SLOPES AND GULLY FOREST	*Eucalyptus tereticornis, E. globoidea, E. saligna/botryoides*		Present on the dissected foothills, confined to the gullies and lower slopes where Eucalyptus saligna/botryoides extends from the escarpment forests into the foothill forests. Virtually all lost
F	MELALEUCA FOREST	Isolated where *Melaleuca* is present without a eucalypt overstorey		Sometimes along creek lines lower slopes. Often attached classes 'E6', E6b' and a common structural component of class 'E12'
G	ACACIA SCRUBS	Where *Acacia* dominates the regenerating scrub. A landscape response to clearing representing areas which once contained a mosaic of Rainforest and Eucalypt forest but predominantly Rainforest – usually heavily infested with Lantana		
G2	ACACIA AND TURPENTINE SCRUBS	Where *Acacia* and Turpentine form mixed scrubs. Often attached to Rainforest polygons. A successional response of the landscape to clearing – often heavily infested with Lantana but may still have Rainforest elements within it		
H	SHRUBLAND	undifferentiated shrublands on heavily disturbed and regenerating environments		
H16	ALLOCASUARINA HEATH	Cliffline Heath dominated by species of the Casuarinacae family		
H2	COASTAL SAND SHRUBLAND	*Leptospermum laevigatum, Acacia sophorae, Banksia integrifolia*		
H4	COAST BANKSIA SHRUBLAND	*Banksia integrifolia ,Leptospermum laevigatum* on headlands		
H8	PLATEAU WET HEATH	*Gymnoschoenus sphaerocephalus, Banksia robur, Gleichenia* spp.		A structural class identifying rocky plates and slopes that have a moist sand layer over them with discharge water creating the Wet Heath ecological niche. Verdant gre belts of Scrambling Coral Fern can be observed within these polygons on the aerial photographs
H8a	PLATEAU DAMP HEATH			A slightly drier environment th Plateau Wet Heath but usually

PRIMARY CODE	DESCRIPTION	DOMINANTS		
				in close proximity
H8b	PLATEAU WET HEATH THICKET			Forming around the edges of Plateau Heaths and along gullies within the Heathland ar into surrounding Woodlands a an Understorey. Sometimes dominated by Banksia ericifoli and may be a successional response to lack of fire
H8d	UPLAND SWAMP DRAINAGE THICKET	Drainage lines through Upland Swamps sometimes with *Leptospermum juniperinum* and *Banksia ericifolia*		
I	FIG	Isolated Fig Trees in cleared Landscapes		
J	SEDGELAND	eg. *Juncus kraussii*		Small low lying areas within th Casuarina glauca forests naturally devoid of trees, sometimes extending as an understorey into Swamp Oak Forests
J4	DISTURBED SEDGELAND			Within the grazed coastal landscape representing disturbed low lying areas that may once have held Swamp Oak Forests, remnant sedges are still present
K1	SWAMP OAK FOREST	*Casuarina glauca*	*Phragmites australis,* Saltmarsh and sedgelands	Forming dense forests occupying the moist soils abutting coastal swamps and lagoons. Often has a very weedy understorey, and sometimes Saltmarsh species are present; it is often associated with Reedbeds. Sometimes has isolated eucalypts (E.) present E. botryoides, E. paniculata, E. robusta, E. tereticornis
K2	RIVER OAK	*Casuarina cunninghamiana*	*Eucalyptus tereticornis, E. saligna/botryoides* and Figs are often isolates scattered through this forest	
L	COASTAL CLIFFS			
L1	ERODING COASTAL CLIFFS			
L3	COALWASTE EMPLACEMENTS			
L4	LAND FILL			
L5	COASTAL ROCK PLATFORMS			
L6	QUARRY			
L7	CLIFF COMPLEX SHRUBLAND	*Banksia serrata, Ceratopetalum apetalum, Allocasuarina verticillata, A. littoralis, Leucopogon spp*		
L8	SANDSTONE TOR SHRUBLAND COMPLEX	Rock Heath dominant with scattered Eucalypts	***E. sieberi, Corymbia gummifera***	Used to isolate rock dominant landscapes that protrude from the plateau forming tors. Also attached as an Understorey attribute
M4	LAKE ILLAWARRA – mudflats			
N	SALTMARSH	*Sarcocornia quinqueflora,*	***Juncus kraussii, Sporobolus virginicus***	

PRIMARY CODE	DESCRIPTION	DOMINANTS	
P	LANTANA		
Q1	NATIVE GRASSLAND	*Themeda australis, Lomandra longifolia*	
Q2	DUNE GRASSLAND	*Spinifex sericeus*	
Q3	NATIVE GRASSLAND	*Themeda australis*	
Q4	NATIVE TUSSOCK GRASSLAND	*Poa labillardieri*	
R2	FOOTHILLS DRY RAINFOREST		
R4	LITTORAL RAINFOREST	*Banksia integrifolia, Acmena smithii, Livistona australis*	
R5	LITTORAL RAINFOREST WITH EMERGENTS		
R6	SUBTROPICAL RAINFOREST	Very old trees. Large Figs and Giant Stingers *Dendrocnide excelsa* present with other very large individuals especially of Red Cedar *Toona australis* and Crab Apple *Schizomeria ovata*	Variable and undulating canopy with large billowing rainforest emergents with vine development – medium to very large crowns – usually confined to benches
R7	WARM TEMPERATE RAINFOREST		
R7/E1	WARM TEMPERATE RAINFOREST WITH EUCALYPT EMERGENTS		
R7a	WARM TEMPERATE RAINFOREST	Small dense, tight crowns on the steep and exposed scree and talus slopes just below the escarpment cliff	Will often have Coachwood Ceratopetalum apetalum and Sassafras Doryphora sassafras dominating the canopy. Sometimes also used to isolate 'younger' rainforest patches within the Class 'R7'.
R7b	WARM TEMPERATE RAINFOREST	*Cerapetalum apetalum,* with some *Ficus* spp. and *Toona australis* still present	Variable and undulating canopy with large billowing rainforest emergents with vine development – medium to very large crowns – usually confined to benches
R9	TURPENTINE FOREST	Dense monospecific stands of *Syncarpia glomulifera*	
S	LAKE ILLAWARRA – Sea Grass		
T	REEDBEDS	*Phragmites australis*	
T1	REEDBEDS	*Typha orientalis*	
TXU/E	URBAN AND INDUSTRIAL LANDSCAPES WITH TREE COVER		
V	EXOTIC TREE		
W2	DAM		
W3	OCEAN – shallow to deep water		
W4	LAGOON		
W5	OCEAN – submerged rock shelves,		
W6	OCEAN SEA GRASS – submerged rock shelves		
W7	LAKE ILLAWARRA - deeper water		
W8	LAKE ILLAWARRA - depositional zones		
X	NO NATIVE VEGETATION COVER		
XC	RURAL LANDSCAPECULTIVATED, CROPPING OR HAY CUTTING		
XQ	URBAN, AND RURAL EXOTIC GRASSLAND		

PRIMARY CODE	DESCRIPTION	DOMINANTS		
XR	RURAL RESIDENTIAL			
XU	URBAN AND INDUSTRIAL LANDSCAPES			
Y	SAND			

Appendix E: Vegetation Survey Proforma

NPWS CENTRAL

CENTRAL
PO Box 1967
Huirstville 2220
T... (02) 9585

SITE ATTRIBUTE 1:

VEGETATION SURVEY

Site

Dat

RECORDER

LOCALITY DESCRIPTION:
.....

MAP CODE:

MAP NAME:

AMG
(1:25 000

ZONE EASTING

Quadrat
m m

GPS READING
(centre of plot)

Cover scale

Grid type

AM GDA

EP No. of satellites

STRATIFICATION: .....LAND TENURE

PHYSICAL DETAILS Erosion: geomorph. action_____

TOPOGRAPHIC POSITION

Altitude (m

Slope o

Aspect o

Morphoterrain (within

Element (within

%

HORIZON ELEVATION (Azimuth)

± ± ± ± ± ± ± ±

% Surface

% bare

Mapped Geology Field Geology No. Photo Film No. Print No.

%

Horizon

Runo

DISTURBANCE HISTORY

	Time since last	Accuracy	Severity	Basis of assessment
Fire				
Logging				
Clearing				
Grazing				
Weeds				
Other				

So

Typ

Dept

Site Condition:

G-Good
A-Average

Distance to nearest

Name of

Note

NPWS
CENTRAL
SITE ATTRIBUTE 2:
STRUCTURAL

Central Directorate
PO Box 1967,
Hurstville, 2220

Site
Dat

COMMUNITY Forest Type

Strata	Form	Lower Height (m)	Upper height (m)	% cover	No.	Species 1	No.	Species 2	No.	Species 3

MORPHO-TERRAIN		ELEMENT	
U	UPPER SLOPE	HSL	HILLSLOPE
		SCA	SCARP
		DUN	DUNE
M	MID-SLOPE	BEN	BENCH
		HSL	HILLSLOPE
		DUN	DUNE
		SCA	SCARP
L	LOWER SLOPE	FOO	FOOTSLOPE
		PED	PEDIMENT
		TAL	TALUS
		HSL	HILLSLOPE
		DUN	DUNE
V	OPEN DEPRESSION	CBE	CHANNEL BENCH
		DDE	DRAINAGE DEPRESSION
		SWL	SWALE
		STC	STREAM CHANNEL
		STB	STREAM BED
		GUL	GULLY
		PST	PRIOR STREAM
		LEV	LEVEE

MORPHO-TERRAIN		ELEMENT	
H	HILLOCK	TOR	TOR
F	FLAT	BKP	BACKPLAIN
		VLF	VALLEY FLAT
		PLA	PLAIN
		FLO	FLOOD-OUT
		LRI	LOW RISE
D	CLOSED DEPRESSION	DOL	DOLINE
		SWP	SWAMP
		PLY	PLAYA
		LAK	LAKE
		PIT	PIT
		OXB	OX-BOW (BILLABONG)
		LAG	LAGOON
S	SLOPE/SIMPLE SLOPE	BAN	BANK
		BAR	BAR
		LRI	LOW RISE
C	CREST	HCR	HILLCREST
		SUS	SUMMIT SURFACE
R	RIDGE	HCR	HILLCREST
		SCR	SCROLL
		SCA	SCARP
		SUS	SUMMIT SURFACE

PATTERN	
ALF	ALLUVIAL FAN
ALP	ALLUVIAL PLAIN
ANA	ANASTOMOTIC PLAIN
BAP	BAR PLAIN
COV	COVERED PLAIN
DEL	DELTA
DUF	DUNEFIELD
ESC	ESCARPMENT
FLP	FLOOD PLAIN
HIL	HILLS
KAR	KARST
LOW	LOW HILLS
MEA	MEANDER PLAIN
MOU	MOUTAINS
PEP	PEDIPLAIN
PLP	PLAYA-PLAIN
PLT	PLATEAU
PNP	PENEPLAIN
RIS	RISES
SAN	SAND PLAIN
SHF	SHEET-FLOOD FAN
STA	STAGNANT ALLUVIAL PLAIN
TER	TERRACE (ALLUVIAL)

CODE	GROWTH FORM	CODE	GROWTH FORM
T	tree	G	tussock grass (discrete open tussocks; agric. grasses)
Y	mallee shrub (<8m)	A	herb/grass complex
M	Mallee tree (>8m)	E	fern
S	shrub (<2m)	L	vine
Z	heath shrub (<2m) ericoid leaves	V	sedge (Cyperaceae Restionacaea)
C	chenopod shrub - halophyte	R	rush (Junicaceae, Typhaceae, Restionaceae & Lomandra)
D	sod grass (compact tussocks in close contact)	F	forb (herbaceous or slightly woody; not a grass)

Code	TENURE
CL	Crown Leasehold
CO	Council reserve
FR	Flora Reserve
NP	National Park
NR	Nature Reserve
PP	Private Property
SF	State Forest
SR	State Rail
SRA	State Rec Area
VCL	Vacant Crown Land
WB	Waterboard

CODE	SOIL DEPTH	CODE	SOIL TYPE
1	Deep	1	Clay
2	Shallow	2	Loam
3	Skeletal	3	Sand
		4	Organic

Code	STRATA Definition
T	Tallest
M3	Mid stratum 3
M2	Mid stratum 2
M1	Mid stratum 1
L3	Lower stratum 3
L2	Lower stratum 2
L1	Lower stratum 1
E	Emergent

Runoff	
MR	MODERATELY RAPID
NIL	NO RUN-OFF
NR	NOT RECORDED
R	RAPID
S	SLOW
VR	VERY RAPID
VS	VERY SLOW

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Po Box 1967
Hurstville 2220

Cover abundance scale 1-7		
1	<5% - Rare or few individuals	3 or less individuals
2	<5% - uncommon	more than 3 - sparsely scattered or localised
3	<5% - common	consistent throughout plot
4a	<5% very abundant	many individuals throughout plot
4b	5% - 25%	
5	25% - 50%	
6	50% - 75%	
7	75% - 100%	

Site

Dat

Quadrat 2 m 2 m i m m

Sample	No.	C/a	Species	Id'd	Sample	No.	C/a	Species	Id'd
	1					21			
	2					22			
	3					23			
	4					24			
	5					25			
	6					26			
	7					27			
	8					28			
	9					29			
	10					30			
	11					31			
	12					32			
	13					33			
	14					34			
	15					35			
	16					36			
	17					37			
	18					38			
	19					39			
	20					40			

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Site

Dat

Quadrat 2 m 2 m i m m

Sample	No.	C/a	Species	Id'd	Sample	No.	C/a	Species	Id'd
	41					61			
	42					62			
	43					63			
	44					64			
	45					65			
	46					66			
	47					67			
	48					68			
	49					69			
	50					70			
	51					71			
	52					72			
	53					73			
	54					74			
	55					75			
	56					76			
	57					77			
	58					78			
	59					79			
	60					80			

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Appendix F: Broad Land Use Zoning Categories by Vegetation Community (hectares)

Vegetation Community Name	Intensive Land Uses	Rural	Conservation Zonings		Dual Res/Conserv. Zonings				Deferred	Total
	(2b,2c,3a,3b,3c,9a,9b,9c,9d,4a,4b,4c,5b,5c)	*1a*	*NPWS Estate*	*7(a) Special Area*	*7(b)*	*6a, 6b*	*7c, 7c1,7d*	*2a,2a1*		
Illawarra Escarpment Subtropical Rainforest	2.47	2.36	152.02	102.15	17.13	0	0	0.51	0	276.64
Coachwood Warm Temperate Rainforest	34.42	24.78	467.72	1084.18	352.8	0.32	34.15	6.49	1.76	2006.62
Robertson Cool-Warm Temperate Rainforest	0	0	0	0	0	0	0	0	0	0
Lowland Dry-Subtropical Rainforest	1.93	47.74	8.69	5.6	204.11	8.26	4.74	6.92	0	287.99
Littoral Windshear Thicket	6.15	0	31.7	11.91	3.36	12.06	2.25	1.55	0.21	69.19
Hind-Dune Littoral Rainforest	0	0	0	1.55	0	0	0	0.34	0	1.89
Cliffline Coachwood Scrub	0	0	1.45	32.41	5.71	0	0	0	9.14	48.71
Escarpment Moist Blue Gum Forest	13.06	14.13	220.94	95.79	162.54	20.03	54.61	26.4	0	607.50
Moist Coastal White Box Forest	16.67	101.95	201.76	101.19	248.18	1.7	2.55	3.78	0	677.78
Moist Gully Gum Forest	12.4	0	145.7	441.87	63.88	0	0	0	0	663.85
Moist Blue Gum-Blackbutt Forest	5.51	0	4.9	270.31	0	0	0	0	0	280.72
Moist Brown Barrel Forest	0	0	0	0	0	0	0	0	0	0
Moist Box-Red Gum Foothills Forest	3.24	127.31	0.06	1.14	224.28	20.43	30.86	32.3	0	439.62
Robertson Basalt Brown Barrel Forest	0	0	0	0.67	0	0	0	0	0	0.67
Moist Shale Messmate Forest	0	0	0	15.74	0	0	0	0	0	15.74
Escarpment Blackbutt Forest	114.41	0	139.9	531.98	295.42	59.74	382.38	298.89	2.56	1825.28
Tall Open Gully Gum Forest	23.16	0	9.68	378.66	0	0	0	0	0	411.50
Tall Open Peppermint-Blue Gum Forest	0	0	3.7	110.45	4.66	0	0.31	0	0	119.12
Tall Open Blackbutt Forest	11.47	0	0.95	124.79	0	0	0	0	0	137.21
Tall Blackbutt-Apple Shale Forest	6.96	0	10.94	45.68	19.91	0	75.89	3.63	0	163.01
O'Hares Creek Shale Forest	0	0	0	2.67	0	0	0	0	0	2.67

Vegetation Community Name	Intensive Land Uses	Rural	Conservation Zonings		Dual Res/Conserv. Zonings				Deferred	Total
	(2b,2c,3a,3b,3c,9a,9b,9c,9d,4a,4b,4c,5b,5c)	*1a*	*NPWS Estate*	*7(a) Special Area*	*7(b)*	*6a, 6b*	*7c, 7c1,7d*	*2a,2a1*		
Highlands Shale Tall Open Forest	0.28	0	0	21.31	0	0	0	0	0	21.59
Coastal Grassy Red Gum Forest	11.12	171.28	0	0	154.15	21.24	42.32	138.09	0	538.20
Lowland Woollybutt-*Melaleuca* Forest	59.3	157.44	0	53.48	16.69	13.21	11.4	46.18	40.11	397.81
Spotted Gum Open Forest	1.43	0	0	0	0	2.08	0	23.39	0	26.90
Escarpment Edge Silvertop Ash Forest	15.23	0	65.88	408.63	66.56	10.93	2.87	0	8.93	579.03
Silvertop Ash Ironstone Woodland	11.3	1.25	5.88	45.72	0	0	0	0	17.89	82.04
Sandstone Gully Apple-Peppermint Forest	15.37	0	76.49	67.82	153.91	1.37	139.02	9.93	0.99	464.90
Sandstone Gully Peppermint Forest	21.11	0	1.81	438.54	7.35	0	0	0	0	468.81
Exposed Sandstone Scribbly Gum Woodland	82.27	0	75.21	751.18	343.84	7.06	240.67	19.39	28.29	1547.91
Nepean Enriched Sandstone Woodland	1.55	0	0	16.34	0	0	0	0	0	17.89
Exposed Bangalay-Banksia Woodland	10.08	0	18.32	63.21	26.03	1.15	22.49	6.83	0.19	148.30
Coastal Sand Bangalay-Blackbutt Forest	2.67	0	0	12.49	0	13.15	0	0.14	0	28.45
Coastal Sand Swamp Mahogany Forest	2.86	0	0	3.21	0	6.34	0	0	0	12.41
Alluvial Swamp Mahogany Forest	2.88	0	0	18.88	0	10.1	0	1.66	0	33.52
Coastal Swamp Oak Forest	17.29	0.1	2.15	32.94	32.28	71.06	1.15	5.93	0.5	163.40
Riparian River Oak Forest	0	9.28	0	0	0.27	0	0	0	0	9.55
Highlands Swamp Gum-*Melaleuca* Woodland	0	0	0	3.65	0	0	0	0	0	3.65
Coastal Sand Freshwater Wetland	0	0	0	3.19	0	0.14	0	0	0	3.33
Upland Swamps: Tea-tree Thicket	0.79	0	2.75	20.7	0	0	0	0	5.25	29.49
Upland Swamps: Banksia Thicket	12.28	0.94	0.9	45.53	50.84	0.07	16.96	1.11	10.61	139.24
Upland Swamps: Sedgeland-Heath Complex	18.02	0	38.06	324.05	77.23	0.12	0.41	0.01	79.84	537.74

Vegetation Community Name	Intensive Land Uses	Rural	Conservation Zonings		Dual Res/Conserv. Zonings				Deferred	Total
	(2b,2c,3a,3b,3c,9a,9b,9c,9d,4a,4b,4c,5b,5c)	*1a*	*NPWS Estate*	*7(a) Special Area*	*7(b)*	*6a, 6b*	*7c, 7c1,7d*	*2a,2a1*		
Upland Swamps: Fringing Eucalypt Woodland	0.01	0	1.02	40.89	3.28	0	0	0	1.69	46.89
Upland Swamps: Mallee-Heath	0.49	0	0	34.5	21.93	0	0	0	0	56.92
Coastal Sand Scrub	17.53	0	0	133.29	0	98.65	0.05	0.66	0	250.18
Coastal Headland Banksia Scrub	11.23	0	4.45	7.82	1.84	23.27	2	3.44	0.22	54.27
Budawang Ash Mallee Scrub	0	0	1.33	4.62	0.7	0	0	0	1.18	7.83
Rock Pavement Heath	0	0	0	1.76	0	0	0	0	0	1.76
Rock Plate Heath-Mallee	7.72	0	0.2	57.63	1.32	0	0	0	0	66.87
Beach Sands Spinifex	0	0	0	6.93	0	14.89	0.05	0.1	0	21.98
Coastal Headland Grasslands	1.14	0	10.62	8.49	0	1	0.24	0.02	0	21.51
Saltmarsh	0.22	0	0	7.96	4.29	2.76	0	0.01	0	15.24
Estuarine Alluvial Wetlands	4.03	1.13	0	6.14	0.81	12.72	0	0.16	0	24.99
Floodplain Wetlands	7.13	2.76	0	24.09	10.87	48.23	0.15	0.04	1.41	94.68




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