




The Native Vegetation of the Woronora, O'Hares and Metropolitan Catchments

Central Conservation Programs and Planning Division
NSW National Parks and Wildlife Service
August 2003

Native Vegetation of the Woronora, O'Hares and Metropolitan Catchments

September 2003

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CONTENTS

1 INTRODUCTION 1

1.1 BACKGROUND 1
1.2 VEGETATION CLASSIFICATION AND MAPPING OBJECTIVES 1
1.2.1 Approach 2
1.3 STUDY AREA 2
1.3.1 Geology and Soils 2
1.3.2 Elevation 5
1.3.3 Rainfall and Temperature 5
1.3.4 Fire History 5
1.3.5 Land Use History 8
1.4 REGIONAL CONTEXT 8

2 METHODS 12

2.1 REVIEW OF EXISTING INFORMATION 12
2.2 SURVEY STRATIFICATION AND SITE SELECTION 13
2.3 FIELD METHODS 13
2.4 DATABASE STORAGE 13
2.5 TAXONOMIC REVIEW 13
2.6 STANDARDISING SPECIES ABUNDACE DATA 14
2.7 VEGETATION CLASSIFICATION 14
2.8 REGIONAL VEGETATION DATA COMPARISON 15
2.9 AERIAL PHOTO INTERPRETATION 15
2.9.1 Patterns in Vegetation Cover 17
2.9.2 Patterns in Canopy Species 17
2.9.3 Understorey Patterns 17
2.9.4 Disturbance Patterns 18
2.9.5 Interpretation Reliability 18
2.10 DIGITAL DATA CAPTURE 20
2.11 VEGETATION COMMUNITY DESCRIPTIONS 20
2.12 MAPPING VEGETATION COMMUNITIES 21
2.13 CONSERVATION STATUS 22
2.13.1 Regional Conservation Assessment 22
2.13.2 Disturbance Assessment 22

3 RESULTS 23

3.1 FIELD SURVEY DATA 23
3.2 AERIAL PHOTO INTERPRETATION 23
3.2.1 Spatial Accuracy 23
3.2.2 Vegetation Cover 25
3.2.3 Interpretation Reliability 25
3.3 VEGETATION CLASSIFICATION 25
3.3.1 Mapping Extant Vegetation Communities 29
3.4 CONSERVATION STATUS 30
3.4.1 Disturbance Assessment 30

4 DISCUSSION 34

4.1 PATTERNS IN VEGETATION COMMUNITIES 34
4.1.1 Shale-Sandstone Transition Forests and Woodlands 34
4.1.2 Elevated Mittagong Sandstone Woodland-Heath 34
4.1.3 Scrubs on Sandy Alluvium 34
4.1.4 Tall Open Forests on Enriched Soils 35
4.1.5 Rainforests and Tall Moist Eucalypt Forests 37
4.1.6 Exposed Sandstone Woodlands and Heath 38
4.1.7 Sandstone Gully Forests 41

4.1.8 Upland Swamp Complex 42
4.1.9 Escarpment Cliffs 43
4.1.10 Cumberland Plain Woodlands 43
4.2 REGIONAL STATUS OF VEGETATION COMMUNITIES 43
4.2.1 Rainforests 47
4.2.2 Moist Forests 48
4.2.3 Tall Open Forests 48
4.2.4 Shale Woodlands 48
4.2.5 Sandstone Forests and Woodlands 48
4.2.6 Mallees, Heaths and Scrubs 49
4.2.7 Upland Swamps 50
4.3 ENDANGERED ECOLOGICAL COMMUNITIES 50
4.4 DISTURBANCE ASSESSMENT 51
4.5 RESERVATION STATUS ASSESSMENT 56
4.6 FIELD IDENTIFICATION OF VEGETATION COMMUNITIES 57
4.7 MAP ACCURACY 58
4.8 USING THE REPORT AND MAP 58

5 REFERENCES 60

APPENDIX A: VEGETATION COMMUNITY PROFILES 63

HOW TO USE THE VEGETATION COMMUNITY PROFILES 63
MU1 ILLAWARRA ESCARPMENT SUBTROPICAL RAINFOREST 66
MU2 COACHWOOD WARM TEMPERATE RAINFOREST 70
MU3 ROBERTSON COOL-WARM TEMPERATE RAINFOREST 73
MU4 SANDSTONE RIPARIAN SCRUB 76
MU5 CLIFFLINE COACHWOOD SCRUB 79
MU6 MOIST BLUE GUM-BLACKBUTT FOREST 82
MU7 MOIST COASTAL WHITE BOX FOREST 85
MU8 MOIST GULLY GUM FOREST 88
MU9 NEPEAN GORGE MOIST FOREST 91
MU10 ROBERTSON BASALT BROWN BARREL FOREST 94
MU11 MOIST SHALE MESSMATE FOREST 97
MU12 HIGHLANDS RIBBON GUM GULLY FOREST 100
MU13 TALL OPEN GULLY GUM FOREST 102
MU14 TALL OPEN PEPPERMINT-BLUE GUM FOREST 105
MU15 TALL OPEN BLACKBUTT FOREST 108
MU16 TALL BLACKBUTT-APPLE SHALE FOREST 111
MU17 O'HARES CREEK SHALE FOREST 114
MU18 HIGHLANDS SHALE TALL OPEN FOREST 117
MU19 TRANSITIONAL SHALE OPEN BLUE GUM FOREST 120
MU20 CUMBERLAND SHALE HILLS WOODLAND 123
MU21 CUMBERLAND SHALE PLAINS WOODLAND 126
MU22 TRANSITIONAL SHALE DRY IRONBARK FOREST 129
MU23 TRANSITIONAL SHALE STRINGYBARK FOREST 132
MU24 HIGHLANDS ALLUVIAL RED GUM WOODLAND 135
MU25 SANDSTONE GULLY APPLE-PEPPERMINT FOREST 137
MU26 SANDSTONE GULLY PEPPERMINT FOREST 140
MU27 NEPEAN SANDSTONE GULLY FOREST 143
MU28 WESTERN SANDSTONE GULLY FOREST 146
MU29 EXPOSED SANDSTONE SCRIBBLY GUM WOODLAND 149
MU30 NEPEAN ENRICHED SANDSTONE WOODLAND 152
MU31 HIGHLANDS SANDSTONE SCRIBBLY GUM WOODLAND 155
MU32 ESCARPMENT EDGE SILVERTOP ASH FOREST 158
MU33 SILVERTOP ASH IRONSTONE WOODLAND 161
MU34 SANDSTONE HEATH-WOODLAND 163
MU35 UPPER GEORGES RIVER SANDSTONE WOODLAND 166
MU36 BUDAWANG ASH MALLEE SCRUB 170

MU37 Dwarf Apple Heath 173
MU38 Rock Pavement Heath 176
MU39 Rock Plate Heath-Mallee 178
MU40 Woronora Tall Mallee-Heath 181
MU41 Highlands Sandstone *Allocasuarina* Heath 184
MU42 Upland Swamps: Banksia Thicket 187
MU43 Upland Swamps: Tea-tree Thicket 190
MU44 Upland Swamps: Sedgeland-Heath Complex 193
(a) Sedgeland 193
(b) Restioid Heath 194
(c) Cyperoid Heath 196
MU45 Upland Swamps: Fringing Eucalypt Woodland 198
MU46 Upland Swamps: Mallee-Heath 201
MU47 Highlands Sandstone Swamp Woodland 203
MU48 Highlands Swamp Gum-*Melaleuca* Woodland 205
Disturbed Landscapes 208

APPENDIX B: SITES BY STRATA ANALYSIS. 210

APPENDIX C: SPECIES LIST. 214

APPENDIX D: API CODES FOR CANOPY SPECIES AND STRUCTURAL TYPES. 241

APPENDIX E: API CODES AND HABITAT CHARACTERISTICS FOR MAP UNITS. 251

1 INTRODUCTION

1.1 BACKGROUND

The Sydney Catchment Authority (SCA) was established in 1999 to manage water supply and protect catchments, supply bulk water and regulate activities within the catchment areas to improve water quality, protect public health and the environment. The Authority was created as a result of the Sydney Water Inquiry, headed by Peter McClellan QC. This Inquiry investigated the water quality incidents experienced by Sydney Water between July and September 1998. The main finding of the Inquiry was that the catchments were seriously compromised by many possible sources of contamination and that Sydney Water did not have sufficient regulatory control of the catchments to guarantee safe drinking water.

The Sydney Catchments Authority has produced an Environmental Plan (2000-2005) that draws together "all of its objectives strategies and targets for the next five years." One of the main initiatives is to "manage its infrastructure, Special Areas and other landholdings for the provision of high quality raw water and for the conservation and enhancement of ecological health and natural and cultural values." One of the mechanisms that has been used to implement this objective is the Special Areas Strategic Plan of Management (SASPoM). This document has been jointly prepared by SCA and NPWS and outlines principles, goals, actions and strategies to be applied to the Special Areas of Warragamba, Woronora, Metropolitan, O'Hares and the Blue Mountains. The document addresses issues such as ecological integrity, fire prevention and control, cultural heritage, water quality and access.

One of the key responsibilities of the SCA is the management of the biodiversity values across the catchments. The lands managed by the SCA are extensive and as such make an enormous contribution to the protection of biota not only to the Sydney Basin Bioregion but also to national and state conservation priorities as well. The Special Areas Senior Managers (SASM) have sought to cover information shortfalls in these areas by implementing a comprehensive biodiversity survey and mapping program across the Special Areas. Detailed information that maps and describes the type, extent, condition and conservation status of native vegetation communities on lands managed by the SCA has been one such research objective. Information of this type will assist in implementing several critical indicators that track the performance of the Environment Plan strategies. These include:

- Extent and Condition of Native Vegetation on SCA owned and managed lands, and
- Flora and fauna species of conservation significance in the water supply catchment area.

This information also delivers a resource that meets Objective 8 of the Environment Plan. This seeks to improve scientific knowledge in the area of catchment protection, water quality and environmental management; and utilise this knowledge to enhance operational and environmental decision-making.

This particular report deals with the Native Vegetation of the Woronora, O'Hares and Metropolitan Catchments.

1.2 VEGETATION CLASSIFICATION AND MAPPING OBJECTIVES

This project aims to:

- Develop a classification system that describes the vegetation communities within the Woronora, O'Hares and Metropolitan Catchments using systematic field data (provided by the SCA) and quantitative analytical methods.
- Review existing vegetation survey and mapping collected at a scale of 1:25000 for inclusion in the mapping products;
- Delineate the extent of native vegetation cover using recent large-scale (1:25000) aerial photography.
- Map the current distribution of the vegetation communities defined through the above aims.

- Examine relationships between the vegetation communities described in the catchments to those occurring elsewhere in the Sydney Basin Bioregion and the reservation status of each of the vegetation communities within both local and regional contexts.
- Map the intensity and type of disturbance present within each vegetation community in the Study Area using recent large-scale aerial photography.

1.2.1 Approach

Classifying and mapping vegetation in NSW has been undertaken using a wide variety of methods and approaches (Benson, 1999; FEWG, 1997). Each method comes with strengths and weaknesses in terms of accuracy, efficiency and rigour (NPWS, 1997). 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 Sydney Catchment Authority completed systematic botanical survey across the Study Area in 1999. This data provided the foundation for the classification tools used in this project.

Mapping of vegetation communities defined by field data is always a process of extrapolation. In this project, Aerial Photo Interpretation (API) and extensive field traverses have 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 catchment management purposes.

1.3 STUDY AREA

The Woronora, O'Hares and Metropolitan Catchments occur on the Woronora Plateau, south west of Sydney. The Study Area covers the water catchments of Nepean, Avon, Cordeaux, Cataract and Woronora Rivers and O'Hares Creek. These catchments combined cover an area of 105,039 hectares of which nearly 87 percent is covered by native vegetation. Map 1 shows the location of the catchments on the Woronora Plateau in relation to Dharawal State Conservation Area, Royal and Heathcote National Parks and Holsworthy Military Area.

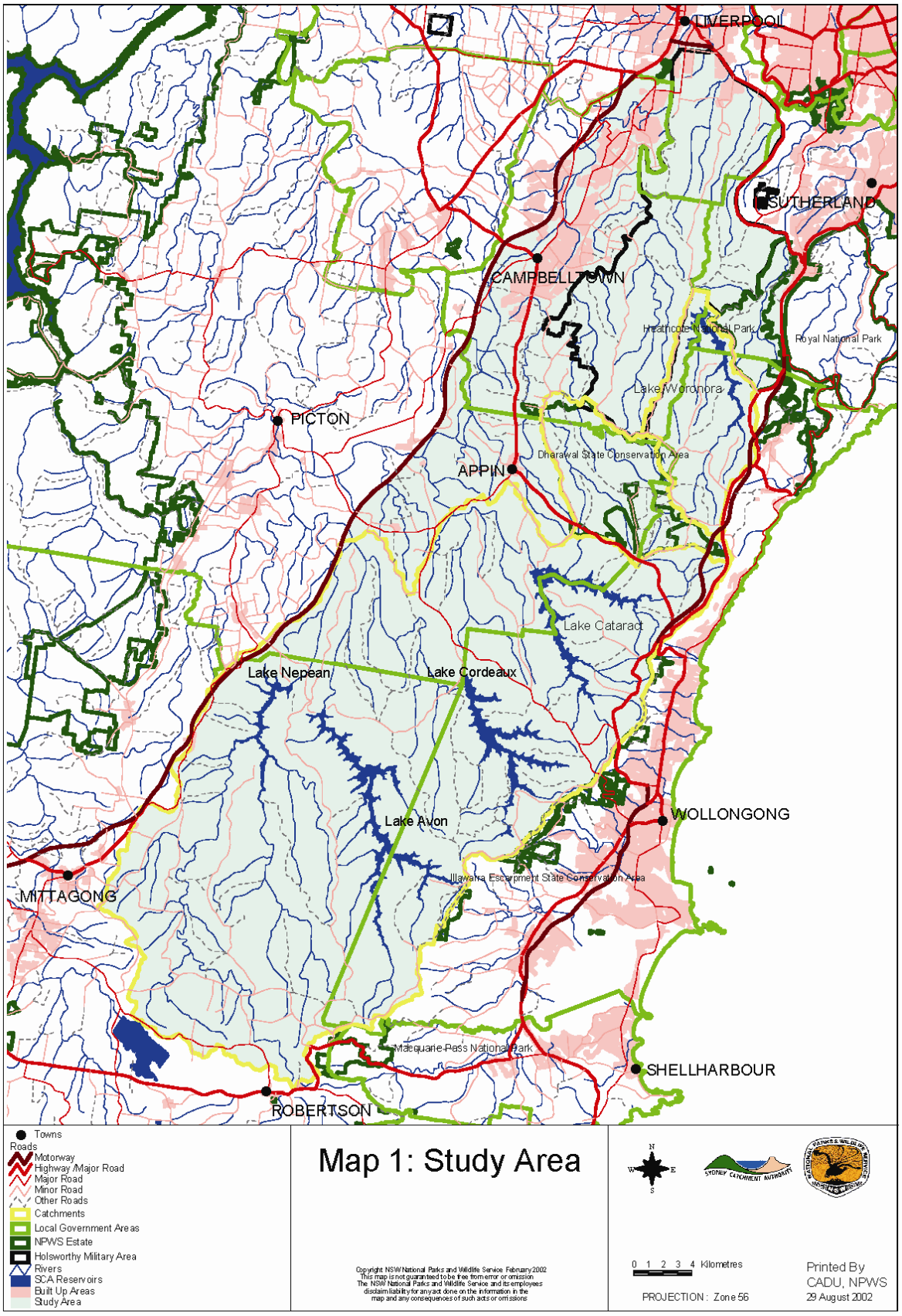
The environmental characteristics of the Woronora Plateau have been well documented in existing studies and reports (see Hazelton *et al*., 1990; Bowman, 1974; Davis, 1941a; Keith, 1994; Benson & Howell, 1994). The following provides a brief summary of that information.

1.3.1 Geology and Soils

Map 2 presents the broad geological classes present in the Study Area. Much of the plateau is dominated by underlying sandstone geologies, primarily derived from the Hawkesbury and Mittagong Formations. The derived material produces a relatively infertile acidic soil and as a result, the prevailing vegetation is a composite of dry sclerophyllous woodlands, forests and heaths. The Mittagong Formation sandstones that form an intergrading sandstone and shale based soil are more common along the western boundary of the Metropolitan Catchment. The resultant landscapes are characterised by very broad flat ridges. Hawkesbury Sandstone is more prevalent within the eastern and central sections of the Study Area.

Amongst the Hawkesbury Sandstones, Quaternary Sand deposits, known as "dells" (Young, 1986), are widespread across the catchments, although they are most extensive in the east, particularly near Maddens Plains. The soil is a combination of coarse sand and heavy organic material, producing a poorly drained substrate that is subject to varying degrees of inundation depending on topographic position.

Hawkesbury Sandstone bedrock in the Woronora and O'Hares Catchments contain substantial areas that support a lateritic mantle. This mantle, termed ironstone, is of varying thickness and structure. The lateritic material is characterised as either highly fragmented plates or lateritic pebbles bound in conglomerate like clusters. This mantle is poorly described in existing geology or soil literature (Bowman, 1974; Hazelton *et al.*, 1990), although vegetation surveyors have discussed such features (Keith, 1994; French *et al.*, 2000; Benson & Howell, 1994).


LIVERPOOL
SUTHERLAND
CAMPBELLTOWN
Heathcote National Park
Royal National Park
Lake Woronora
PICTON
Dharawal State Conservation Area
APPIN
Lake Cataract
Lake Nepean
Lake Cordeaux
Lake Avon
WOLLONGONG
Illawarra Escarpment State Conservation Area
MITTAGONG
Macquarie Pass National Park
SHELLHARBOUR
ROBERTSON
Towns
Roads
Motorway
Highway /Major Road
Major Road
Minor Road
Other Roads
Catchments
Local Government Areas
NPWS Estate
Holsworthy Military Area
Rivers
SCA Reservoirs
Built Up Areas
Study Area
Map 1: Study Area
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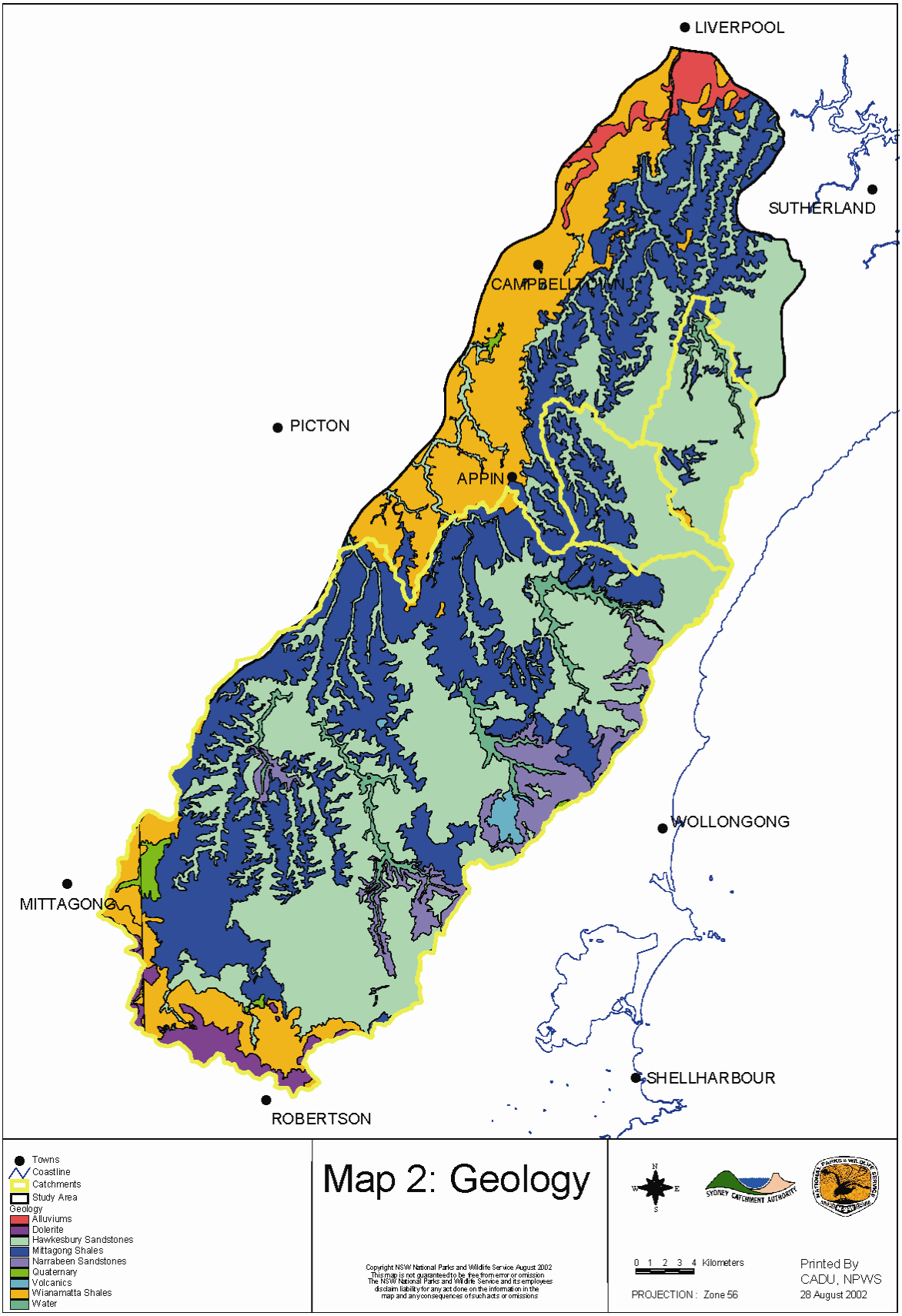
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MITTAGONG
SHELLHARBOUR
ROBERTSON
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Hawkesbury Sandstones
Mittagong Shales
Narrabeen Sandstones
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Elsewhere, Narrabeen Group Geology appears in the heavily dissected valleys south of Appin Road. The derived soils are a combination of both lithic sandstones and fine-grained chocolate shales and mudrocks. They are a richer soil, with a greater content of clay providing a higher moisture retaining capacity than the siliceous sandstones. While the sandstones within the Narrabeen Group are similar to the properties found within Hawkesbury Sandstones, they are invariably enriched to varying degrees by the more easily eroded shale material (Davis, 1941a). Narrabeen Geology is not extensive in the Study Area. The variations in soil types found amongst the series are not well defined or mapped in existing literature.

Shales of the Wianamatta Group are a residual shale soil occurring patchily throughout the Study Area. The largest patches of shale remain in an arc along the southern and south western area of the Nepean Catchment between Robertson and Wilton. Patches remain across all catchments, although most are isolated and small. The shale material appears to vary depending on the thickness of the soil. Siliceous materials found within the underlying sandstone bedrock can influence the composition of the shale soil.

Soils derived from volcanic material are prevalent on the Robertson Plateau on the far south of the Study Area and a small area of adjoining Lake Cordeaux. These Tertiary Basalt and Crinanite geologies provide the most fertile soils of the region, producing a rich red loam. As a result native vegetation has largely been cleared from these environments. Basaltic necks are found at Izards Knob and Cupitts Forest, and a Trachyte intrusion is present at Mount Cotopaxi. Thomas (1990) also notes that a small area of basalt is present in Allen Creek in the Cataract Catchment.

1.3.2 Elevation

The Woronora Plateau has been termed the “Nepean Ramp” owing to the gradual decline in elevation along a south to north west axis (Young & Young, 1988). The highest point reaches 850 metres near East Kangaloon. Elevations above 500 metres form about a quarter of the total Study Area. Map 3 shows that the lowest elevations are reached in the gullies behind Lake Woronora in the far north. The elevations at this point are around 110 metres and fall further as the river descends toward the Georges River. The majority of the catchments lie between 250 and 550 metres. The gentle dip between the east and west means that rivers flow west from the Illawarra Escarpment edge from elevations of around 400 metres to around 70 metres on the Wianamatta Shales of the Cumberland Plain at Campbelltown.

1.3.3 Rainfall and Temperature

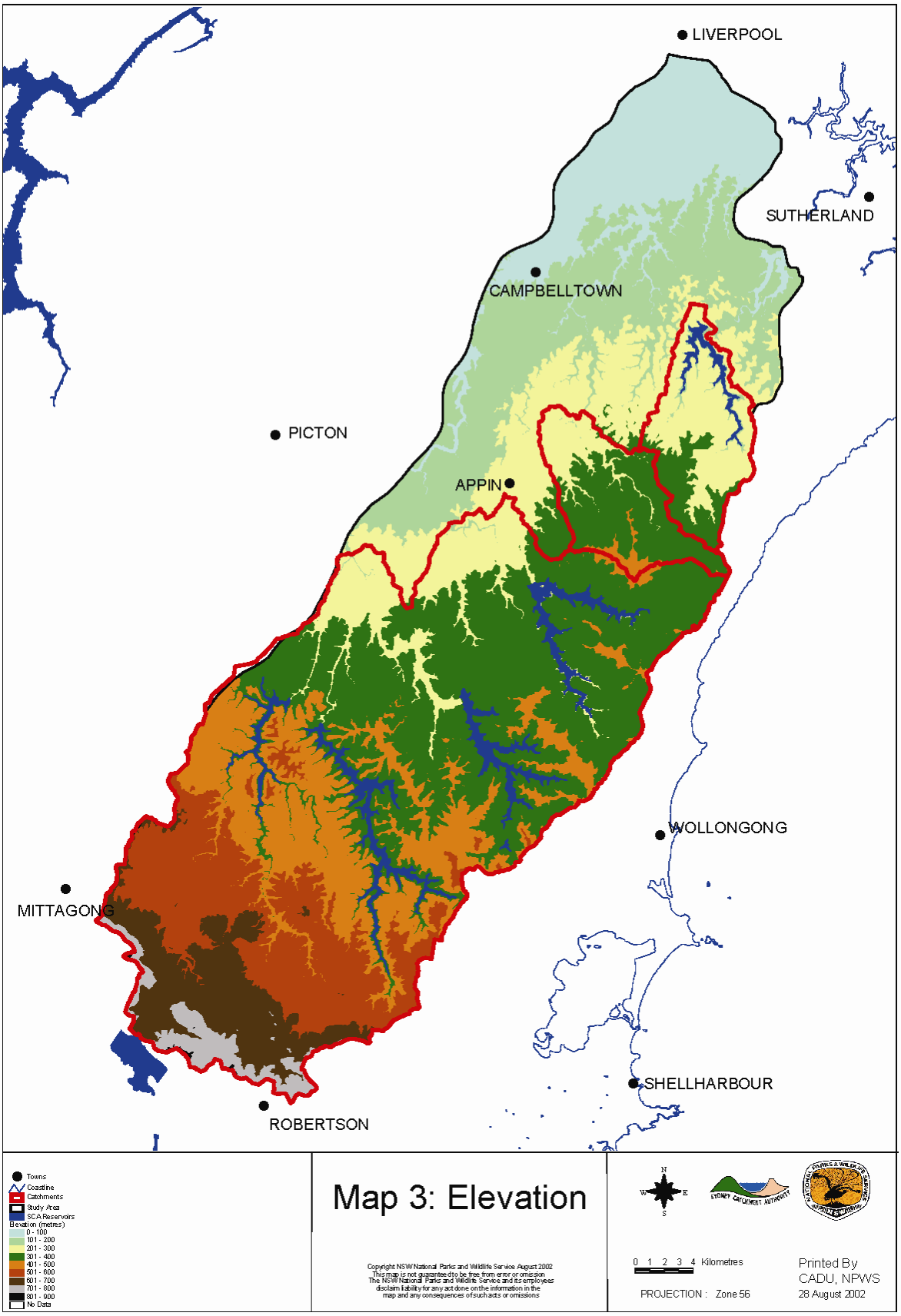
Mean annual rainfall follows a broad decline as distance from the escarpment edge increases. At Mt. Kembla the mean annual rainfall level reaches 1700 millimetres per annum, with falls up to 1800 millimetres recorded at Mt. Keira (Benson & Howell, 1994). Map 4 illustrates that the rainfall level declines to around 750 millimetres near Campbelltown and Bargo on the western edge of the Metropolitan Catchment. Almost half of the Study Area receives over 1000 millimetres per year. Thomas (1990) notes that the eastern edge of the Cordeaux and Avon Catchments are subject to occasional dramatic deluges that have reached 430 millimetres in a 24 hour period.

The temperature variations more closely follow elevation patterns. In the west, near Bargo and Picton, summers are generally warmer as they are not cooled by the mitigating summer sea breezes. Temperature are hottest in January (with a mean of 29 C at Picton; 25 C at Upper Avon River) and coldest in July-August (mean of 15 C at Picton; 13 C at Kangaloon). Cooler temperatures are also a feature of the higher elevations of the Southern Highlands, between Robertson and Alpine. Fogs are frequent along the escarpment edge between Lake Avon and Mt. Keira and also north from Bulli.

Winds are characterised by south east summer breezes and gusty south westers during the winter months.

1.3.4 Fire History

Map 5 presents information describing the frequency with which the Study Area has been affected by fire since 1970. O’Hares, western Cordeaux, and southern Nepean Catchments have been most frequently burnt. Recent wildfires during December 2001 and January 2002 were the most extensive in the Study Area since 1968. The Catchments of Woronora, O’Hares, Nepean and Avon were all extensively burnt during this period.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MITTAGONG
SHELLHARBOUR
ROBERTSON
Towns
Coastline
Catchments
Study Area
SCA Reservoirs
Elevation (metres)
0 - 100
101 - 200
201 - 300
301 - 400
401 - 500
501 - 600
601 - 700
701 - 800
801 - 900
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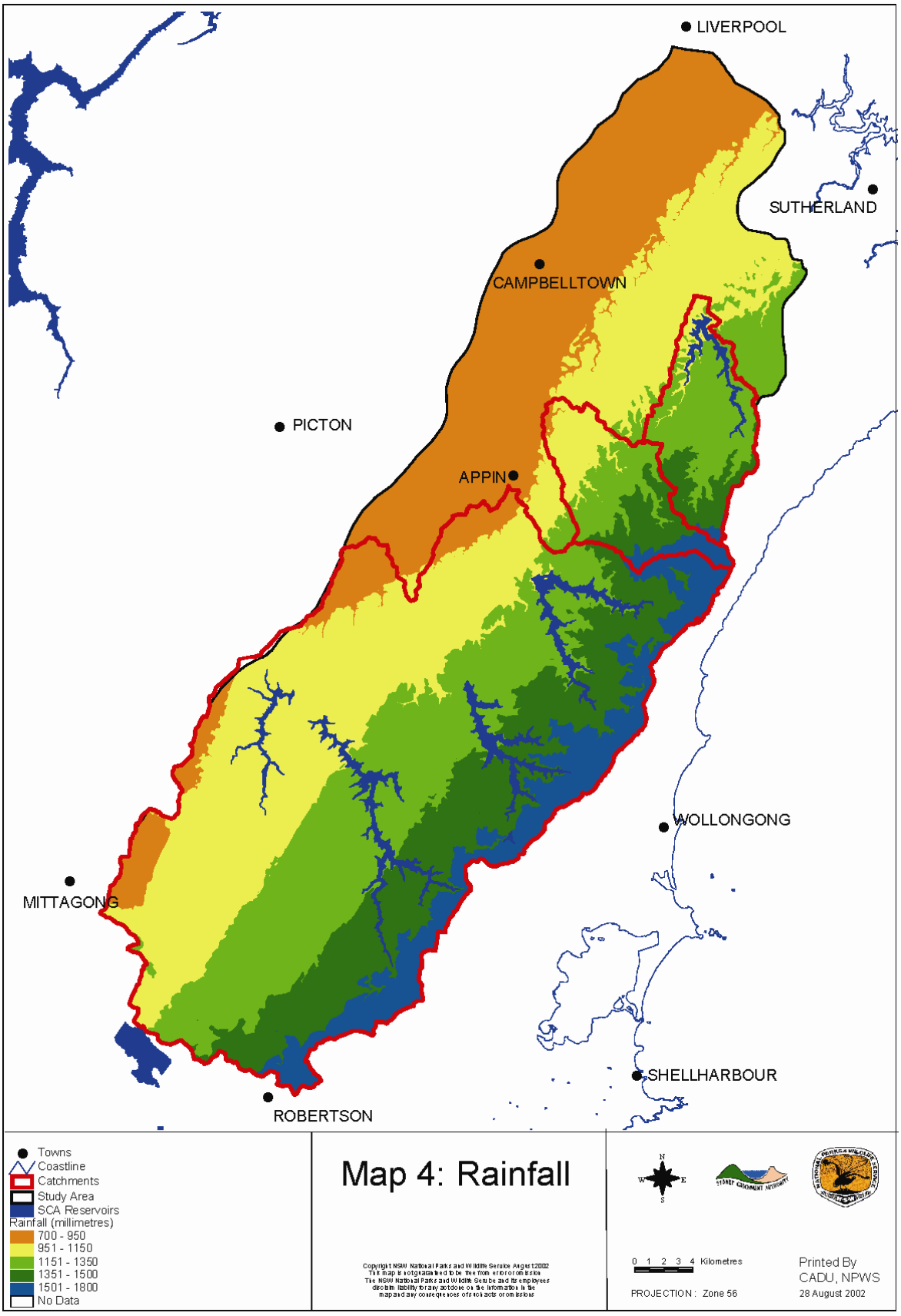
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APPIN
WOLLONGONG
MITTAGONG
SHELLHARBOUR
ROBERTSON
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Coastline
Catchments
Study Area
SCA Reservoirs
Rainfall (millimetres)
700 - 950
951 - 1150
1151 - 1350
1351 - 1500
1501 - 1800
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Map 4: Rainfall
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1.3.5 Land Use History

At the time of European arrival, the Woronora Plateau was inextricably bound with the culture of the indigenous people occupying the land. The Dharawal Tribe is known to have used the area extensively. Widespread archaeological artefacts and art sites are examples of the material evidence of such use. Present day oral histories are likely to be equally compelling in their references to food resources, travel routes and sites of significance.

Less than five years after the Port Jackson settlement in 1788 Europeans were frequenting the Illawarra. This area was targeted by the new settlers for Red cedar (*Toona ciliata*) that grows amongst the lush warm temperate and subtropical rainforests. Much of the sandstone plateau was rejected for agricultural pursuits because of its infertile soils. However, on the richer basaltic soils on the Robertson Plateau and Cordeaux Crinanite, and the shale soils between Bargo and Liverpool, agricultural and pastoral activities were approached with earnest. Extensive land clearing has resulted, leaving only fragments of once extensive rainforests, forests and woodlands. Thomas (1990) notes that prior to 1900, around fifteen percent of the catchments were covered by agricultural holdings.

In the 1860's a Royal Commission resolved that the Upper Nepean Scheme should be implemented in order to meet the growing demand for water from the Sydney. Between 1900 and 1935 five dams were constructed, flooding the Avon, Nepean, Cataract, Cordeaux and Woronora River Valleys. Land that was not already dedicated for water supply purposes was resumed gradually. Villages present in Cordeaux Valley and Sherbrooke near Cataract Creek slowly declined and today are non existent. However, previous disturbance from logging and land clearing is evident today with simplified, disturbed and regenerating vegetation present near accessible areas. Agricultural and pastoral activities remain within the Metropolitan Catchment in the Robertson-Mittagong area, and orchards and horse riding farms are still present at Darkes Forest and Kembla West.

The discovery of coal in the Illawarra in 1794 established mining as one of the primary industries of the region. Long wall mining has resulted in a network of ventilation shafts at numerous locations across the plateau. These shafts extend to the Illawarra Coal Measure stratigraphy, which lies around 200 metres below the surface. These coal mining activities also contribute to the plethora of transmission line easements, pipelines, access routes and fire trails that span the ridgelines of the plateau. More recently the Eastern Gas pipeline has dissected the southern and eastern portions of the Metropolitan Catchment. The F6 Freeway, Appin and Picton Roads, and the Princes Highway provide the main public thoroughfares through the Woronora Plateau.

1.4 REGIONAL CONTEXT

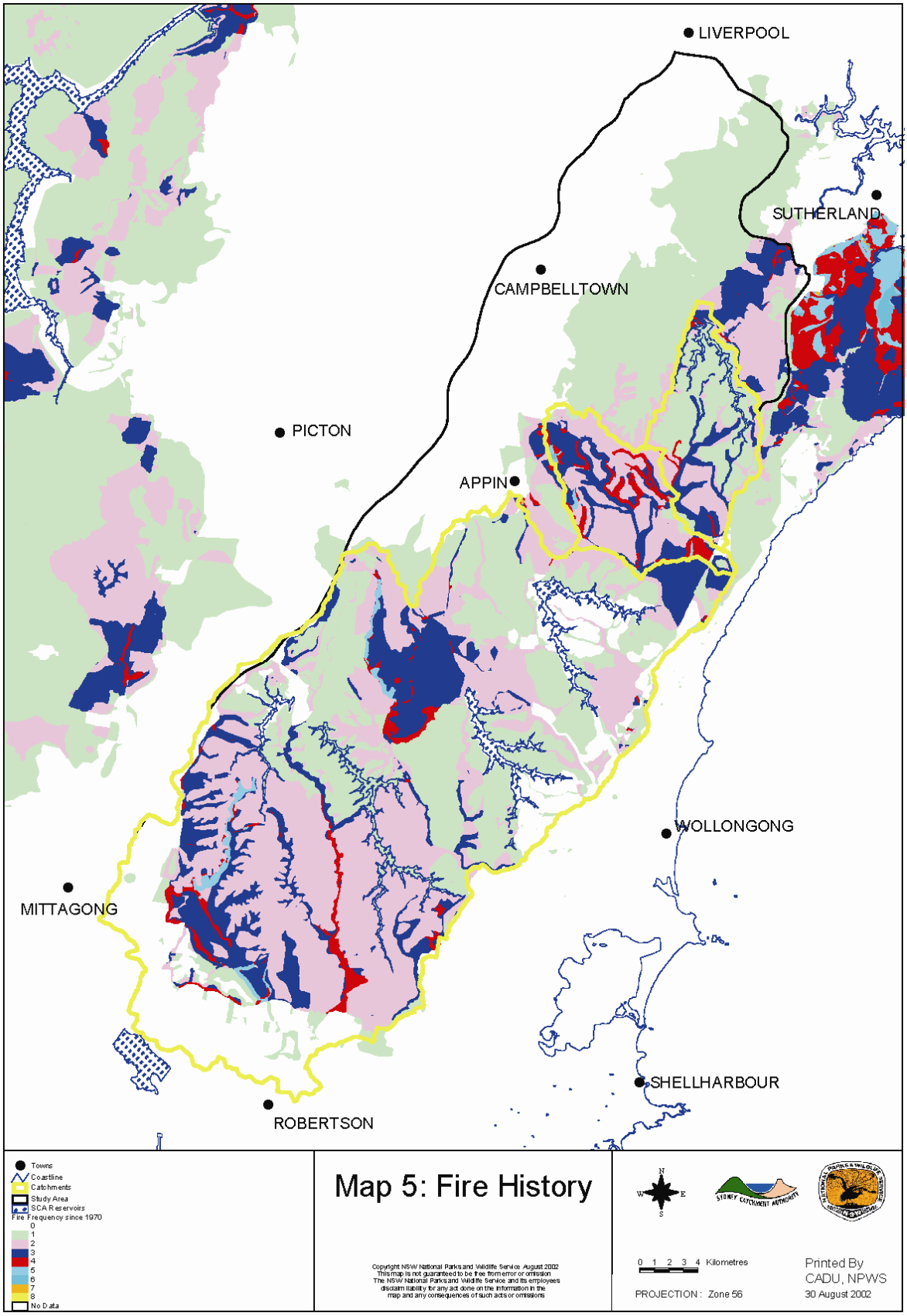
The Woronora Plateau is situated within the Sydney Basin Bioregion (Thackway & Creswell, 1995). It has been identified as one of 80 Australian Bioregions in the Interim Biogeographic Regionalisation of Australia (IBRA). These Bioregions are identified and mapped on the basis of similarity between climate, geological and vegetation features. Map 6 illustrates the location of the Sydney Basin Bioregion. It extends from near Ulladulla on the south coast to the Hunter Valley and west to include the Blue Mountains Sandstone Plateaux.

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 Woronora, O'Hares and Metropolitan Catchments in a consistent and rigorous manner.

1.5 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 (NPWS), Chris Chafer (SCA) and Mary Knowles (SCA). Daniel Connolly undertook data analysis and produced this report. Peter Ewin undertook geographic information system (GIS) and database management. Field survey in the SCA catchments was undertaken by Chris Chafer, Mark Robinson, Claire de Lacey, Jason Andersen, Steven Chamberlain and Gary Leaonard. Field survey in the Illawarra was undertaken by Christopher Pennay, Jedda Lemmon, David Thomas, Daniel Connolly and Peter Ewin. Field survey for the Wingecarribee Council vegetation mapping was by Mark Tozer, Daniel Tindall, David Keith and Steven House. Field

survey for the O'Hares Creek catchment and Royal National Park mapping was by David Keith. Field survey in western Sydney and the Georges River catchment mapping was by Mark Tozer, Christopher Simpson and Nathan Kearnes. Aerial photograph interpretation and data capture was undertaken by Ian Roberts (ERA) and PinTech Pty Ltd. Joshua Madden completed data entry. NPWS Illawarra Area staff have provided ongoing support to the project.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Catchments
Study Area
SCA Reservoirs
Fire Frequency since 1970
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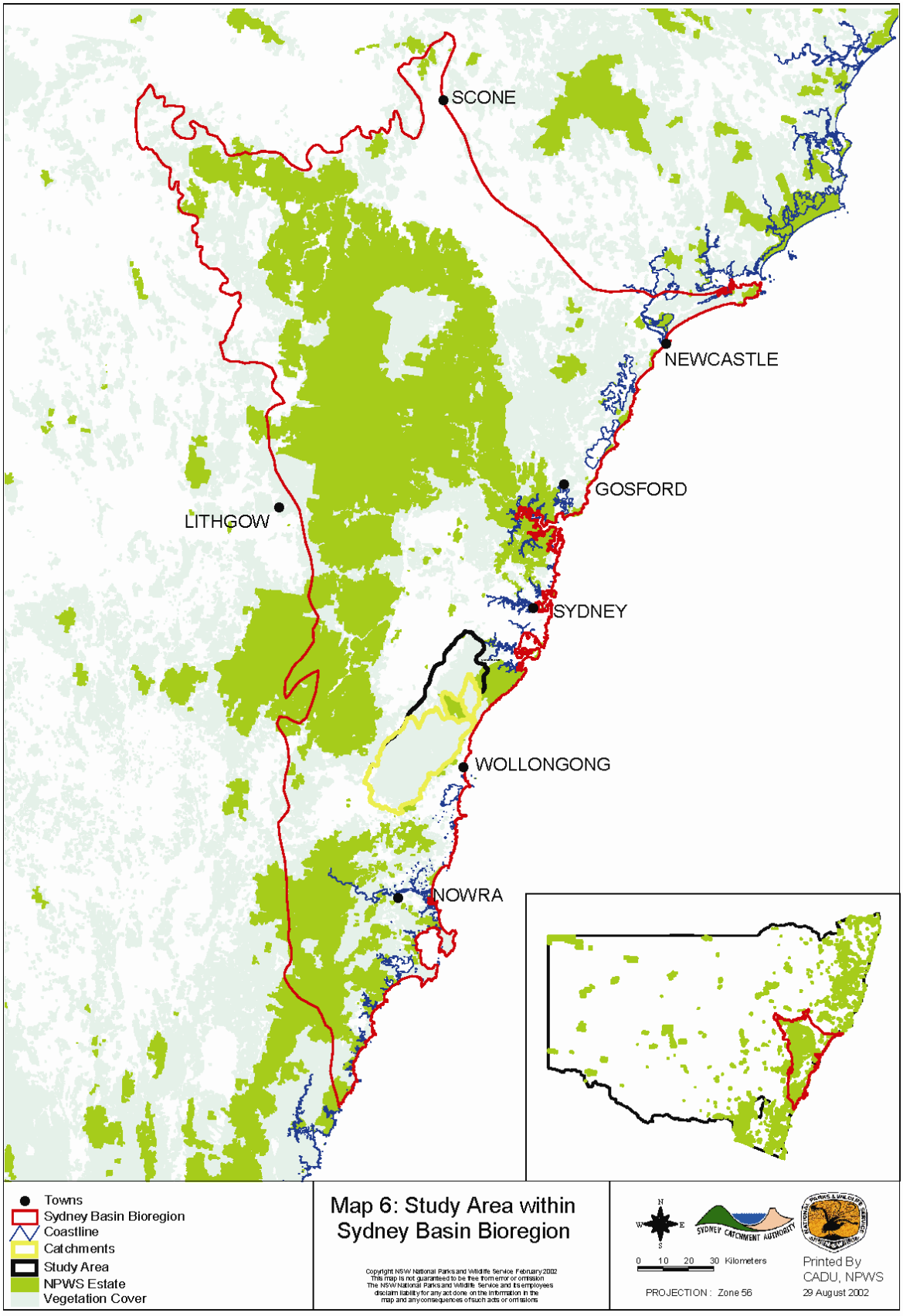
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SYDNEY
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Coastline
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Vegetation Cover
Map 6: Study Area within Sydney Basin Bioregion
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29 August 2002

2 METHODS

2.1 REVIEW OF EXISTING INFORMATION

The native vegetation of the Woronora Plateau has been the focus of several previous studies that have examined particular types of vegetation or particular areas within it. Davis (1936, 1941a, 1941b) produced several papers describing the distribution of plant communities in the Bulli District. More recently, Benson & Howell (1994) have produced a detailed profile of many of the vegetation communities present, and mapped these at a broad regional scale of 1:100000. Keith (1994) completed a detailed study of the vegetation communities of the O'Hares Creek Catchment. This work incorporated some of his previous work on the upland swamps (Keith & Myerscough, 1993). Thomas (1990) and Mills & Jakeman (1995) have examined the rainforests of the catchments and adjoining escarpment. In the northern Woronora Plateau, beyond the Woronora Catchment, detailed studies have been produced for the Holsworthy Military Area (French *et al*., 2000), the Georges River Catchment (NPWS, 2000c) and for the Campbelltown LGA (NPWS, 2000e). David Keith has completed preliminary mapping for Royal National Park. Recent survey and mapping of the Cumberland Plain (NPWS, 2000d) has covered some small areas of shale forests along the western fringe of the Study Area. The vegetation of the Southern Highlands has had preliminary descriptions compiled by Benson & Howell (1994). NPWS (2000a) mapped parts of Wingecarribee Shire Council as part of the Southern Regional Comprehensive Regional Assessment and more recently Eco Logical Australia (2002) mapped the vegetation of the entire Local Government Area (LGA). In addition, Kodela (1996) investigated the historical context of vegetation on the Robertson Plateau in his palaeogeographical study. NCC (1999) summarised much of the available literature in order to describe the vegetation communities occurring in the greater Illawarra region. The Wollongong Escarpment and Coastal Plain has also recently been mapped (NPWS, 2002) in order to meet long term environmental planning and assessment needs. Numerous smaller vegetation studies also exist that have dealt with particular development and environmental impact issues.

TABLE 1: EXISTING REGIONAL SITE DATA

Area	Source	Number of Sites
Cumberland Plain, Western Sydney	NPWS (2000d)	403
Royal National Park	D. Keith	276
Wingecarribee LGA	NPWS (2000a) Eco Logical Australia (2002)	25
Warragamba Special Area	SCA and NPWS	675
Woronora and Metropolitan Catchments and Special Area	SCA	376
Dharawal State Conservation Area	Keith (1994)	56
Wollongong Escarpment and Coastal Plain	NPWS (2002)	198
Holsworthy Military Area	French *et al.* (2000)	73
Lower Hunter and Central Coast Region	NPWS (2000b)	354

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. A large number of systematic sites were available for use in this project. These have been listed in Table 1 and describe those datasets used to help classify the native vegetation of the Woronora, O'Hares and Metropolitan Catchments in relation to both the entire Woronora Plateau and the Sydney Basin Bioregion.

2.2 SURVEY STRATIFICATION AND SITE SELECTION

The primary dataset for the Study Area was collected by the SCA in 1999. A total of 376 sites were completed across Avon, Nepean, Cordeaux, Cataract and Woronora Catchments. These data were collected to examine changes in floristic composition and diversity within vegetation communities that result from fire. The Study Area was stratified using five 'time since fire' classes (0-2 years, 3-7 years, 8-12 years, 12-30 years, 30+ years) and at least seven vegetation map units as described by Benson & Howell (1994): Sandstone Ridgetop Woodland (10ar); Sandstone Gully Forest (10ag); Upland Swamps (21s); Moist Forests (6l and 6j); Rainforests (8d) and Shale Forests (10x and 9mf). The road and trail network was buffered to a distance of 100 metres to identify easily accessible areas and overlaid on the strata using a GIS system. A random point generator was then used to allocate sites to strata within the buffered area (C. Chafer, *pers. comm.*).

Field survey sites completed in Holsworthy Military Area, O'Hares Creek Catchment, Royal National Park, the Wollongong Escarpment and Coastal Plain, Western Sydney and Wingecarribee Shire were stratified among categories of parent material, vegetation structure and topography. Details on these studies are found in Keith (1994), French *et al*. (2000), NPWS (2000d, 2002) and Eco Logical Australia (2002).

For the purposes of review, a new stratification was employed to examine the sampling adequacy of all available sites in relation to the environmental variation present in the Study Area. A combination of dominant lithology (five classes), rainfall (four classes) and aspect (four classes) was created. Data layers were derived in a GIS system and combined. Sites were then overlaid on the derived strata to examine sampling performance.

2.3 FIELD METHODS

Standard field sites completed by the SCA were fixed to 0.04 hectares (20mX20m). At each site all vascular plant species were recorded and assigned a cover abundance score using a six point Braun-Blanquet scale (Poore, 1955): 1-rare few individuals present and cover <5%; 2-common and <5% cover; 3-cover >5% and <25%; 4-cover >25% and <50%; 5-cover >50% and <75%; 6-cover >75%. Coarse notes on the structure of the vegetation at each site were sometimes completed. This included dominant species of each stratum, height and cover abundance.

Identical plot sizes were used for other studies although a modified seven point Braun-Blanquet abundance score was used in Royal, O'Hares Creek, Holsworthy, Campbelltown LGA, Illawarra and Wingecarribee Shire Vegetation Mapping. The seven point scale is as follows: 1-rare few individuals present and cover <5%; 2-uncommon and <5% cover; 3-common and <5%; 4-very abundant and cover <5% OR cover >5% and <25%; 5-cover >25% and <50%; 6-cover >50% and <75%; 7-cover >75%.

2.4 DATABASE STORAGE

Field data was been collated from various electronic formats and entered into an ACCESS database. This database ensures that all species are allocated a standard coding system using the Census of Australian Vascular Plant Species (CAPS). New species or subspecies, as identified by the Royal Botanic Gardens (4/3/02), not previously listed in the CAPS were assigned new codes to the master CAPS database.

2.5 TAXONOMIC REVIEW

For this project, all nomenclature was reviewed and standardised across data sets for analysis. Species lists already available in Benson & Howell (1994) and Keith (1994) were also used as a guide during the review. Synonyms were updated to reflect currently accepted revisions. The treatment given in Harden (1990-93) and revisions (Harden, 2000, 2002) were used as a standard. The principle outcomes of the taxonomic review were:

- 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.

- 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 variety if only one taxa 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.
- The review highlighted species identified to genus level only. These were deleted from the analysis dataset.
- The taxonomic review identified that there were inconsistently identified species amongst different observers for particular closely related species. An example of this problem occurred with the species of Scribbly gum Eucalypts. There were inconsistent identifications between observers for *Eucalyptus sclerophylla, E. racemosa, E. haemastoma* and hybrids between the latter species. It is likely that all three species exist, although for the purposes of the analyses, all scribbly gums were defined as *Eucalyptus racemosa*.
- Some recent taxonomic revisions could not be accommodated. Examples include *Hakea dactyloides*, which was known to have two forms – multi-stemmed, which has now been named *H. laevipes* subsp. *laevipes* and a single-stemmed form that remains as *H. dactyloides*. Not all observers identified to the form level and consequently data could not be consistently transformed.

The complete list of species recorded during surveys is provided in Appendix C.

2.6 STANDARDISING SPECIES ABUNDANCE DATA

A number of different existing surveys employed different methods of measuring species abundance at a site. The main differences were between those sites that used a six point Braun-Blanquet scale to those that used a seven point scale (French *et al.*, 2000; NPWS, 2000d, 2002). Data from O'Hares Creek was originally recorded using absolute abundance for all species. All data was standardised to a 6 point scale as the majority of the data conformed to this measure. Table 2 below describes the conversion rules.

2.7 VEGETATION CLASSIFICATION

Quantitative numerical analyses have already been applied to subsets of the data to help classify vegetation communities in parts of the Study Area (Keith, 1994; NPWS, 2000b, 2000c, 2000d, 2002). The aim is to understand these communities and to reassess their hierarchal structure with the addition of new field data.

Several different iterations were run on the combined dataset. The Bray-Curtis and Kulczyski coefficients were generated to identify dissimilarity between survey sites. The PATN (Belbin, 1994) package was used for this purpose. An association matrix calculating 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. These analyses were also repeated on the same dataset with abundance scores reduced to a simple presence (value of 1) or absence (value of 0) score. The purpose of the latter technique was twofold. Firstly, 346 sites were originally stratified on fire history and as a result may falsely identify patterns on the basis of post fire abundance scores recorded for some species. Secondly, a large number of observers were present in the dataset with potential for wide variations in abundance scoring, botanical experience and identification skill. While the assessment of presence and absence data increases the ability of rare species to influence the classification, it does avoid abundance score bias that can arise from inexperienced observers.

TABLE 2: TRANSFER BETWEEN 6 POINT AND 7 POINT ABUNDANCE SCORES

Cover abundance scale 1-7		1 - 6 scale conversion	
1	<5% - rare or few individuals	1	sparse <5%
2	<5% - uncommon	1	sparse <5%
3	<5% - common	2	any number < 5%
4a	<5% - very abundant	2	any number < 5%
4b	5 - 25%	3	5 - 25%
5	25 - 50%	4	25 - 50%
6	50 - 75%	5	50 - 75%
7	75 - 100%	6	75 - 100%

Dendrograms were produced to display the hierarchical relationships between individual sites and groups of sites for all iterations. 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 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 analysis of site data, and purpose of the classification and mapping exercise.

Sites that had been subject to previous analyses were identified and examined in relation to new field data. An initial broad grouping of sites provided the start point for further analyses. Groups of sites were examined using the species that characterise the group, structural features such as height and eucalypt cover, and physical characteristics such as geology, topographic position and aspect. Each broad group was split to uncover finer scale floristic assemblages in a sequential manner. Broad groups were split where an obvious variation in canopy species was present in order to assist field identification.

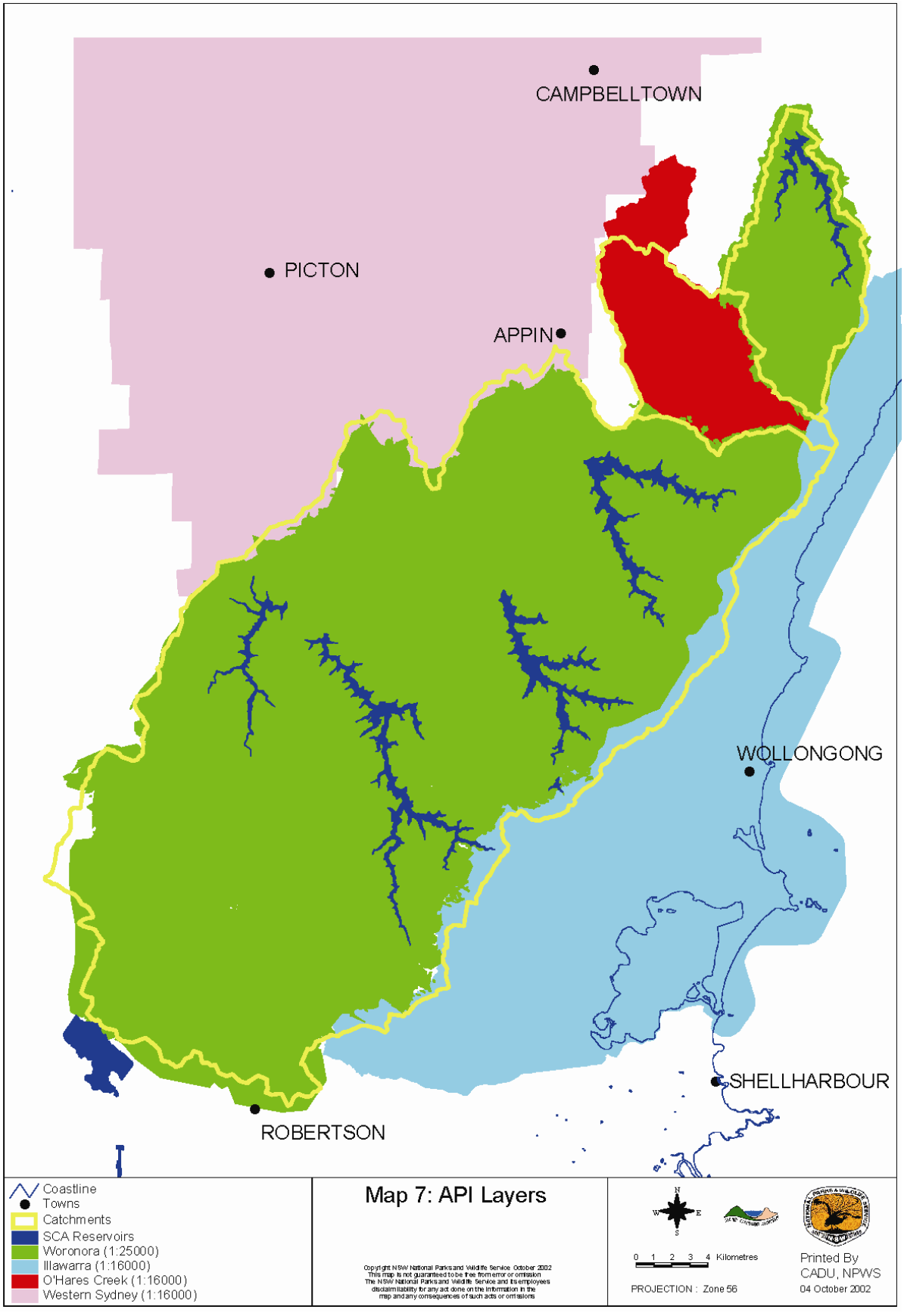
A number of communities have been provisionally identified from field traverse and aerial photograph interpretation only.

2.8 REGIONAL VEGETATION DATA COMPARISON

Vegetation communities identified in this report were reviewed in order to determine their reservation status within the Sydney Basin Bioregion. The inclusion of site data beyond the boundary of the Special Areas also affords an understanding of vegetation characteristics within neighbouring areas. Descriptions of regional status have been derived by tracking sites used in this analysis to their parent community identified in existing literature. Vegetation communities, particularly those in the southern catchments, were compared qualitatively to those described during the South Coast Comprehensive Regional Assessment process (NPWS, 2000a).

2.9 AERIAL PHOTO INTERPRETATION

Aerial Photo Interpretation (API) was required in order to complete a coverage of the Study Area at a scale of 1:25000. Detailed API was available for the O'Hares Creek Catchment (Keith, 1994). This study utilised 1:16000 scale photos flown in 1991. Given the scale of mapping already complete and comments suggesting only minor disturbance across the area outside of shale forests, the area was not remapped. In addition, both the western and eastern edges of the Study Area have been recently mapped at 1:16000 scale by NPWS (2000a, 2002).


CAMPBELLTOWN
PICTON
APPIN
WOLLONGONG
SHELLHARBOUR
ROBERTSON
Coastline
Towns
Catchments
SCA Reservoirs
Woronora (1:25000)
Illawarra (1:16000)
O'Hares Creek (1:16000)
Western Sydney (1:16000)
Map 7: API Layers
Copyright NSW National Parks and Wildlife Service October 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 Kilometres
PROJECTION : Zone 56
Printed By
CADU, NPWS
04 October 2002

New Aerial Photo Interpretation (API) has been completed across the remaining area using 1994, 1:25000 scale photographs. The coverage of each of the data layers used for this project is shown in Map 7.

API completed for this project was tied to explicit mapping rules to ensure consistency in interpretation of features across the Study Area. The following rules, with minor variations have been used across the entire Study Area excluding the O'Hares Creek Catchment.

2.9.1 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 patches to contiguous extensive cover. All vegetation cover, except O'Hares Creek Catchment, was mapped using consistent criteria as follows:

No Vegetation Cover (Code X)

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

Sparse/Scattered Vegetation Cover (Code Tx/A/B/C)

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 one hectare was used. Vegetation cover coded as 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; and

Tx/U scattered trees above urban development.

Tree cover greater than ten percent Crown Canopy Projection and greater than one hectare (AA.B/C/DD)

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 is greater than one hectare 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.

2.9.2 Patterns in Canopy Species

All vegetation cover was allocated a canopy species code based on the dominant combinations of upper strata species. Prior to the commencement of fieldwork potential combinations of species were identified from the analyses of field survey data. Existing research on vegetation patterns in the Study Area (Fuller, 1980; Fuller & Mills, 1985; Benson & Fallding, 1985; Keith, 1994; Benson & Howell, 1994; NCC, 1999) was also used to assist with the field assessment. A complete table of vegetation patterns identified by API is presented in Appendix D.

2.9.3 Understorey Patterns

Broad classes of understorey characteristics were interpreted where they were visible. These features are described in Table 3. 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. Understorey was only collected to refine or describe variations in pattern to that commonly found in association with the prevailing overstorey and landscape feature. As an example, sandstone woodlands with a canopy of Scribbly gums (*Eucalyptus racemosa*/*sclerophylla*/*haemastoma*), Silvertop ash (*E. sieberi*) and Red bloodwood

(*Corymbia gummifera*) are an extensive feature and are characterised by a heathy understorey of sclerophyllous shrubs. However, at times the same combination of canopy species are present above an understorey typical of upland swamps or bare rock. These unique features have been highlighted with an understorey tag using the codes below. If no understorey tag is present then the characteristic understorey species can be assumed to be present.

TABLE 3: 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

2.9.4 Disturbance Patterns

All vegetation cover was assessed for disturbance. Codes to highlight the intensity and type of disturbance were only applied where these features were visible from aerial photography. Where disturbance is present, 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 in Table 4. The dominant disturbance type has also been coded. These are described in the Disturbance Feature Code Column.

2.9.5 Interpretation Reliability

Four classes of interpreter mapping confidence were applied to each mapped polygon. These classes enable users to understand the reliability of the mapping features. The confidence levels are presented in Table 5.

TABLE 4: DISTURBANCE INTENSITY AND DISTURBANCE TYPE CODES

Interpreters Disturbance Assessment	Indicates the following patterns	Disturbance Feature Code	Disturbance Feature (To be Developed Further)
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	Landslip 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
		D	Regrowth dominant (>30%)
		E	Regrowth minor
		F	Soil disturbance high
		G	Soil disturbance low
		H	Understorey patchy
		I	Landslip evidence

TABLE 5: INTERPRETER 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	Patterns consistent with general trend although less certainty with some or all of the polygon attributes
Class 4: Low	Feature unusual, API uncertain, unconfident interpretation

2.10 DIGITAL DATA CAPTURE

Mapping linework was transferred from photograph overlays using a three-step process. Firstly, control points were established on each individual photograph against a stable base of the 1:25000 topographic maps. The linework was then scanned and rectified against these control points and the 25 metre grid Digital Elevation Model. The rectification is necessary in order to resolve the spatial distortion that is inherent in oblique aerial photographs. Each polygon is then labelled in accordance with the API Floristics Code Table (Appendix D). An ArcINFO coverage is then generated supporting built topology. Standard tolerances (DNRE, 1998) were used to control for transfer errors. The preliminary coverage was then examined for spatial accuracy against both the topographic maps and 1:40000 ortho-rectified photo images (SCA, 2002) to identify errors. Missing or incorrect polygon labels were also identified and returned to the interpreter for correction. Four polygon fields were established to describe vegetation type, understorey type, mapping reliability, and disturbance assessment/type.

API coverages for Western Sydney, O'Hares Creek and the Wollongong Escarpment were edge matched against the new coverage for this study. Linework was corrected in ArcINFO against orthorectified digital aerial imagery. Edge matching between the Wollongong Escarpment and this study occurred during the API fieldwork phase. Boundaries between coverages were split on a cleared boundary such as a road or powerline easements.

2.11 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. Common species in each vegetation layer are provided along with summary height (metres) and cover (total projected canopy cover) percentages. These figures are estimates only taken from field notes, as many sites did not record vegetation structure data.

Each vegetation community has been given a label to describe the structure, dominant or characteristic species (generally tree species), broad understorey descriptor and/or a geological or topological feature. Naming strategies are inherently flawed in that they attempt to summarise a highly variable entity. Rules for naming are generally headlines that rarely hold true for all samples that describe the community. As a consequence, names that are only broadly descriptive of habitat rarely provide an initial picture of the vegetation community to the layperson. Conversely, use of specific features such as dominant tree species are often contradicted by field data. Despite the limitations of the latter, this project has used these methods to assist community recognition.

In some cases, naming convention follows that used in previous studies. Some previous names are no longer appropriate because geographic range or floristic composition has been found to differ from the original description. As far as possible, Endangered Ecological Communities have retained their name except in cases where the definition is broad enough to encompass several distinct communities. Floristic descriptions have been taken from existing NPWS reports (NPWS 2000a, 2000b, 2000c, 2002). In most cases, these communities occur on the edge of the Catchments and are more comprehensively described elsewhere.

The profile provides a brief summary of key identifying features. These include obvious 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. Notes are provided on the distribution of the community outside of the Study Area and within the Sydney Basin Bioregion.

A table providing a list of diagnostic species is provided for all vegetation communities described using systematically collected site data. Diagnostic species for communities were identified using criteria employed by Keith & Bedward (1999). 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 same species may only occur patchily, at low abundance or not all. These patterns can be quantified by analysing the site data of the Study Area. Table 6 describes the criteria used to define positive, negative, uninformative and constant species. Positive species are those that are recorded more frequently within a community and/or at a higher median cover abundance than in all other vegetation communities. 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, less 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 species 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 6: 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

2.12 MAPPING VEGETATION COMMUNITIES

The distribution of vegetation communities has been mapped using a combination of air photo pattern, geology, elevation and rainfall. Many vegetation communities present within the Study Area are restricted to distinctive habitats and are easily discernible using aerial photo patterns. These include rainforests, heaths and mallee-heaths, residual shale forests, swamps and sedgelands. A large number of map units described from field data were mapped directly during field traverse during the aerial mapping phase. Map Units 1, 3, 4, 5, 18, 19, 22, 23, 36, and 38 to 48 were mapped by relating directly to analogous aerial mapping codes (see Appendix E).

Habitat characteristics for each vegetation community were identified by using a Geographic Information System (GIS) to intersect field site data with environmental data layers. These data layers described rainfall, elevation, aspect and geology. The results derived for each map unit are presented in Appendix E. To delineate trends median scores were generated for geology classes, means and minimum and maximum values for raw rainfall and elevation values and modal scores for aspect classes.

Eucalypt dominant forests and woodlands were allocated map unit codes by using a combination of canopy species codes, understorey characteristics and environmental characteristics presented in Appendix E. Sandstone vegetation dominated by Eucalypts (Map Units 25 to 35) exhibited floristic variation based on gradual changes in environmental conditions. These were not always discernible using aerial photo pattern, although often a characteristic canopy species observed on photos can be used to distinguish different communities. Canopy Species codes for these map units were intersected with elevation and rainfall scores (Appendix E) to delineate the grade from one community to another. Nearest whole polygons were chosen either side of the mean score line and allocated to the relevant map unit.

Eucalypt forests found on richer soils (Map Units 7 to 16, and 18) underlain by shale geology or Narrabeen sandstone were allocated to map unit using soil data. Tall Eucalypt forests found on basalt were allocated to Map Unit 10. Moist forest polygons (forests with understorey codes A or B) found on Hawkesbury and Mittagong geology were allocated to Map Unit 9. Tall Forests found on Narrabeen Sandstones were allocated to a moist forest or tall open forest group using understorey codes. Dominant canopy species was used to differentiate map units of similar vegetation structure. Allocation of map unit boundaries at the interface between Hawkesbury and Narrabeen geologies often produced a discrepancy between the mapped geology and the mapped aerial mapping code. By way of example, Eucalypt forests that mark this gradation are characterised by the presence of *Eucalyptus piperata.* The understorey features a change however from a dense shrub layer supporting species typical of exposed sandstone environments to a sparse shrub layer with a ground cover of *Lomandra longifolia.* Resolving the precise

boundary between map units 26 and 13/14 was not easily achieved, and has for the purposes of this map selected understorey code to discriminate between map units.

2.13 CONSERVATION STATUS

2.13.1 Regional Conservation Assessment

Most of the Study Area is comprised of land that is managed by the SCA, with limited access to the public. Only along the boundaries, particularly in the south, are large areas of land within private land. The remaining area is managed directly by the SCA, with a clear charter to protect biodiversity values.

Many vegetation communities described in this report extend beyond the Study Area. The extant area of each community within the Sydney Basin Bioregion is presented within each community profile, along with the proportion that is present within NPWS managed lands, such as National Parks and Nature Reserves.

2.13.2 Disturbance Assessment

The relative condition of each Vegetation Community was examined using a gross disturbance index mapped during the aerial photo interpretation phase. Each level of disturbance intensity was calculated as a proportion against the total distribution of each community within the Study Area. These proportions and the area (hectares) figures have been included within each vegetation community profile.

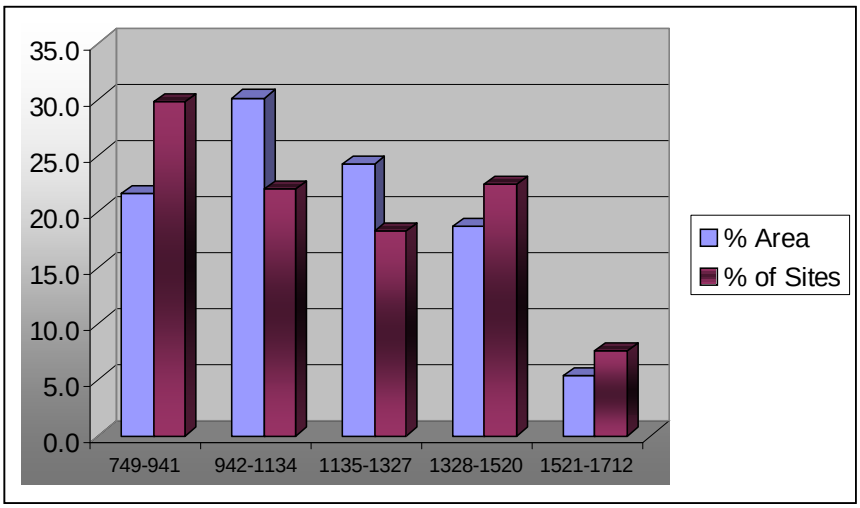
3 RESULTS

3.1 FIELD SURVEY DATA

A total of 576 sites were compiled for the analysis. A map showing the locations of all sites used in the analytical phase is presented in Map 8.

The sampling review suggests that most strata have received replicated survey effort (Appendix B). The major climatic and elevation gradients have been sampled, as have the dominant geological patterns. Inaccessible areas in the Avon and Nepean Catchments contain fewer sample points, as do several of the smaller scale vegetation features, such as heaths and swamps. Figure 1 below provides an indication of sampling effort against rainfall classes.

FIGURE 1: COMPARISON BETWEEN PROPORTION OF SAMPLING EFFORT TO THE PROPORTION OF RAINALL CLASSES FOUND IN THE STUDY AREA (X AXIS IS RAINFALL (MM) AND Y AXIS IS PERCENTAGE SCORE)



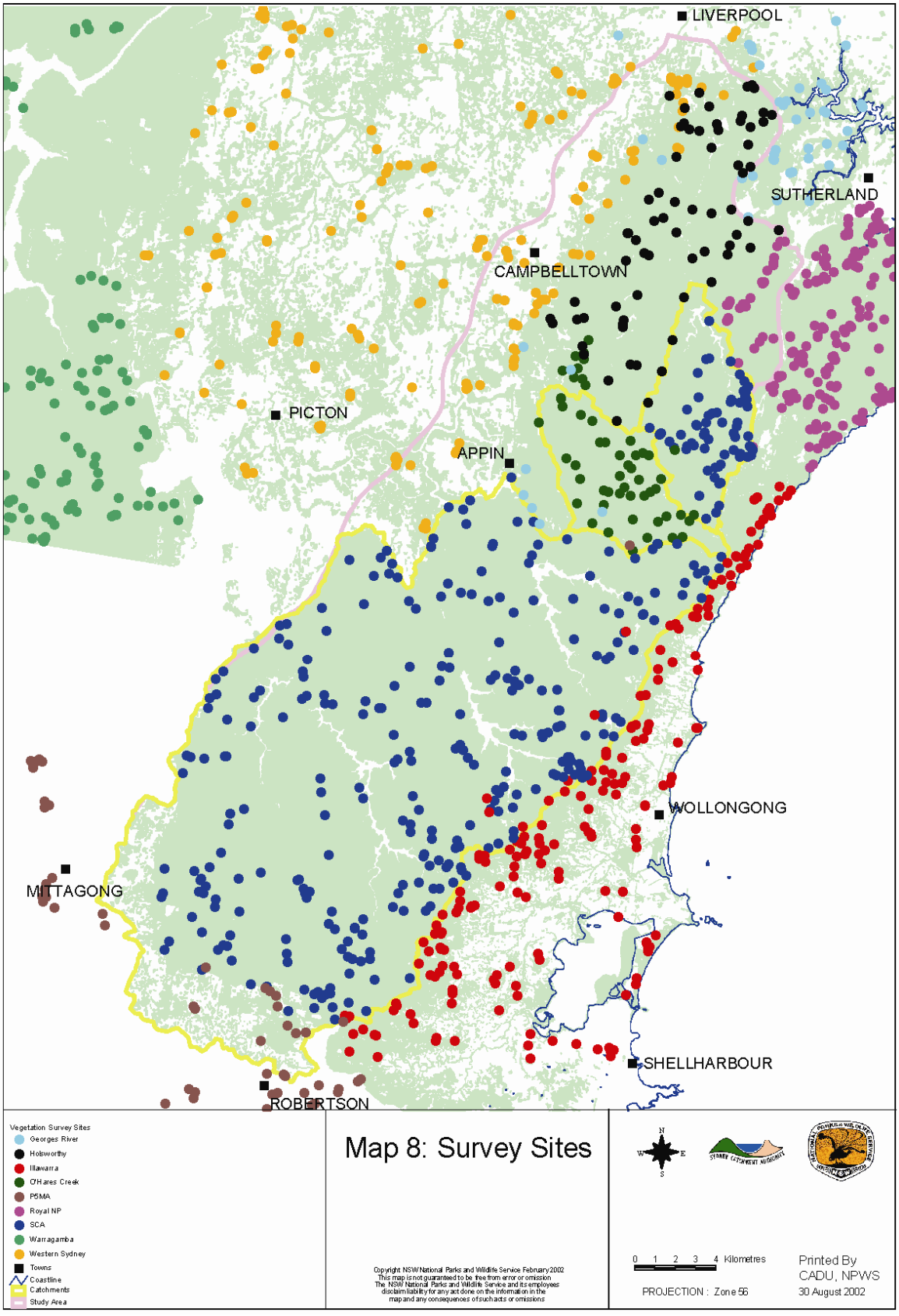
3.2 AERIAL PHOTO INTERPRETATION

Aerial photograph interpretation of vegetation patterns has been completed over all areas within the Special Areas that have not been subject to other recent fine scale mapping. In total over 100 different landscape features have been mapped. These include vegetation patterns, and physical and structural attributes.

3.2.1 Spatial Accuracy

The spatial accuracy of the API data layer is based on a detailed comparison of ten percent of polygons against linear and high contrast landscape features obvious in the ortho-rectified 2002 SCA air photo images for the Study Area.

- Over 95 percent were found to be within a tolerance of 37.5 metres. Spatial accuracy is best on flat to undulating topography of the plateaux and plains and worst on the steep escarpment slopes and dissected valleys where displacement from air photos is greatest.
- Coding transfer error between photo linework and digital coverage was found to be less than one percent.


LIVERPOOL
SUTHERLAND
CAMPBELLTOWN
PICTON
APPIN
WOLLONGONG
MITTAGONG
SHELLHARBOUR
ROBERTSON
Vegetation Survey Sites
Georges River
Holsworthy
Illawarra
O'Hares Creek
PSMA
Royal NP
SCA
Warragamba
Western Sydney
Towns
Coastline
Catchments
Study Area
Map 8: Survey Sites
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map and any consequences of such acts or omissions
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3.2.2 Vegetation Cover

The combined coverages of vegetation mapping indicate that a total of just under 91,000 hectares were identified as native vegetation cover greater than 0.5 ha in size. This comprises nearly 87 percent of the Study Area. Table 7 below indicates the proportion of mapping features found in the Study Area. Map 8 shows the area supporting native vegetation cover within the Study Area.

TABLE 7: BROAD API MAPPING FEATURES WITH AREA AND PROPORTION OF STUDY AREA

Broad Mapping Feature	Area (ha)	Proportion (%)
Native Vegetation Cover >0.5 hectares	90964.6	86.7
Cleared, Urban or Exotic Vegetation	8839.8	8.4
Scattered Native Trees	1400.6	1.3
Regenerating Vegetation	448.0	0.4
Water Bodies (Reservoirs)	3385.5	3.2
Total	105038.5	100

3.2.3 Interpretation Reliability

The classes describing the confidence in the interpretation of the landscape features are shown in Map 9. 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 as a result of private land access or by physical distance. It should be noted that no reliability scores were assigned to vegetation mapping polygons in the O'Hares Catchment, although many boundaries have been delineated in the field (Keith, 1994).

3.3 VEGETATION CLASSIFICATION

Vegetation communities have been identified using two methods. Quantitative analysis of site data was used to identify the dominant vegetation communities wherever possible. Available site data did not sample all communities described in existing literature. In such cases, these sources have been used to describe the floristic composition and habitat. Two communities not previously identified in the literature and lacking field samples have been provisionally identified.

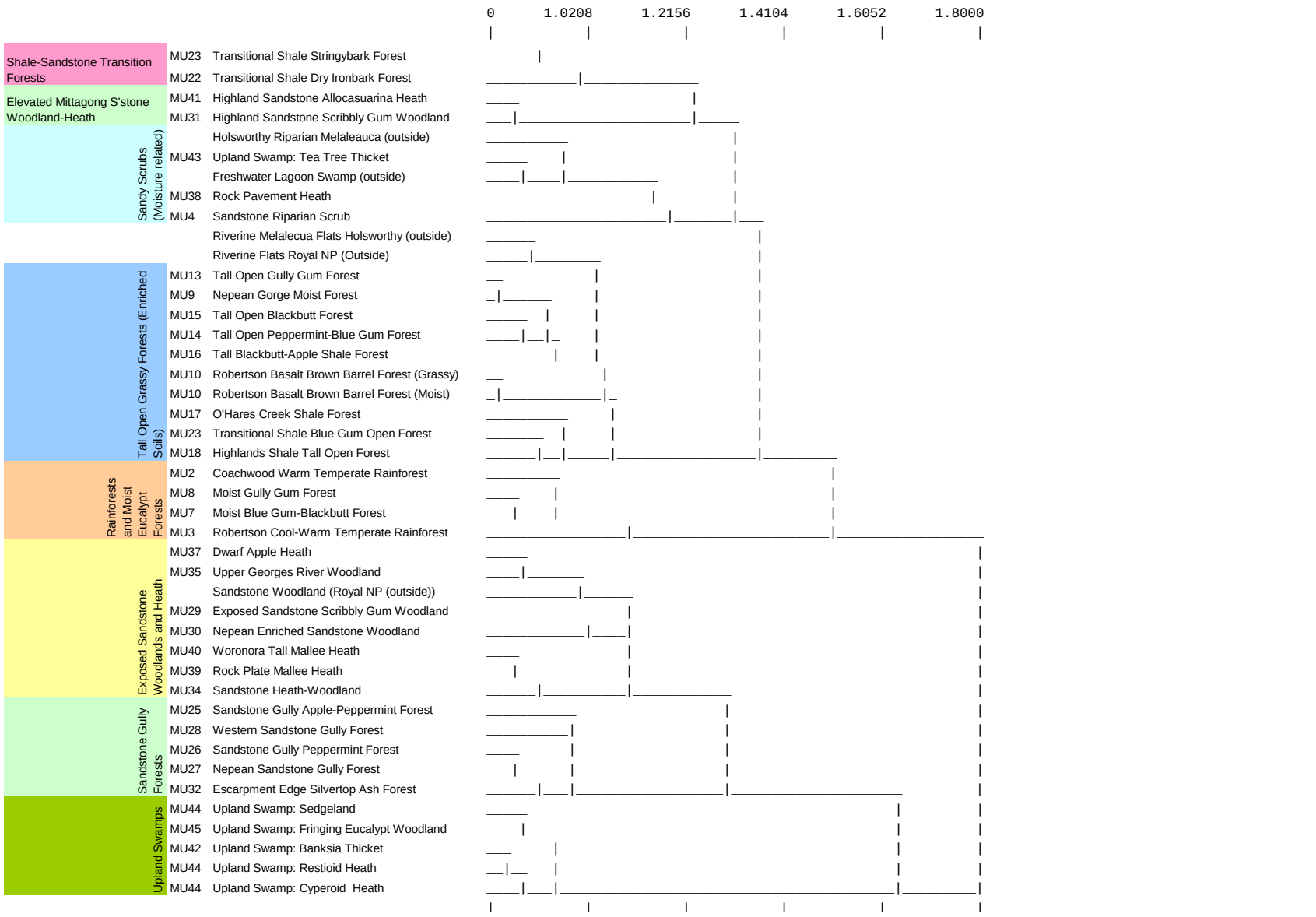
The dendrogram resulting from the hierarchal classification highlighted eight broad groups of sites from which 41 vegetation communities were identified. A simplified dendrogram is presented in Figure 2.

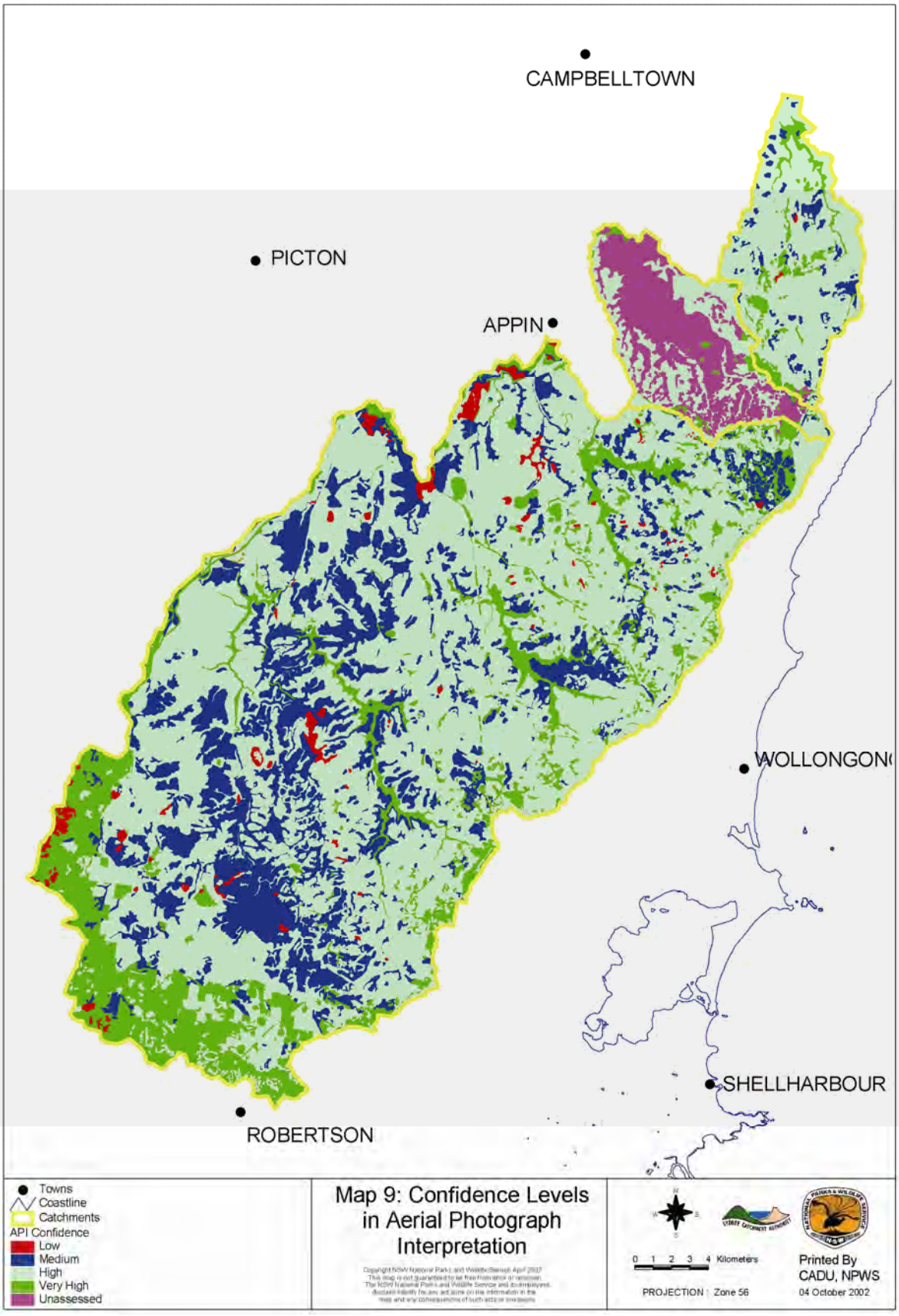
The first of the eight major groups describes the vegetation that occurs on residual shale caps and the interface of shale and sandstone soils along the drier western band of the Study Area. Vegetation communities here form tall woodlands and forests with an open understorey that supports species found on both shale soils of the adjoining Cumberland Plain and the sandstone woodlands of the surrounding plateau. The second broad group describes open woodlands and dry heath found on Mittagong Sandstone in the far south west of the Study Area.

often supporting a grassy understorey that occupy sheltered habitats on Hawkesbury Sandstone geologies. The next group presents communities united by exposed habitats, again on infertile sandstone geology. The third represents the sedgelands and heaths present in the upland swamps. Rock plate heath and riparian scrubs characterise the fourth and fifth groups. The sixth summarises the dry open woodlands on transitional shale-sandstone geologies prevalent in the west of the Study Area. Tall open eucalypt forests on more fertile shales and Narrabeen Sandstones comprise the seventh group. The final group represents the combination of rainforest communities.

Full descriptions of each vegetation community are presented in Appendix A.

FIGURE 2: SIMPLIFIED DENDROGRAM SHOWING HIERACHIAL STRUCTURE OF NATIVE VEGETATION COMMUNITIES IDENTIFIED FROM SITE DATA

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Coastline
Catchments
API Confidence
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Medium
High
Very High
Unassessed
Map 9: Confidence Levels in Aerial Photograph Interpretation
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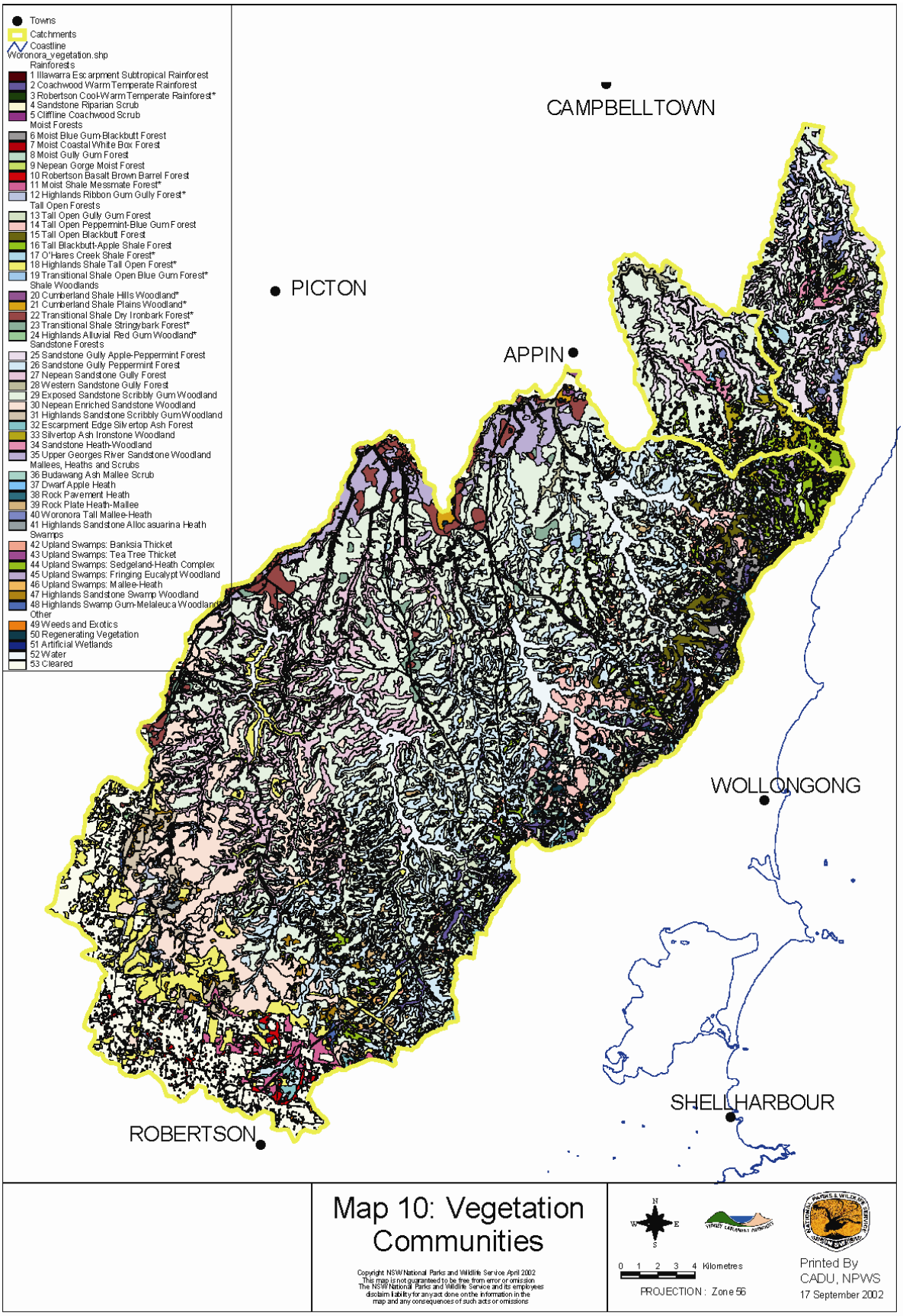
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Rainforests
1 Illawarra Escarpment Subtropical Rainforest
2 Coachwood Warm Temperate Rainforest
3 Robertson Cool-Warm Temperate Rainforest*
4 Sandstone Riparian Scrub
5 Cliffline Coachwood Scrub
Moist Forests
6 Moist Blue Gum-Blackbutt Forest
7 Moist Coastal White Box Forest
8 Moist Gully Gum Forest
9 Nepean Gorge Moist Forest
10 Robertson Basalt Brown Barrel Forest
11 Moist Shale Messmate Forest*
12 Highlands Ribbon Gum Gully Forest*
Tall Open Forests
13 Tall Open Gully Gum Forest
14 Tall Open Peppermint-Blue Gum Forest
15 Tall Open Blackbutt Forest
16 Tall Blackbutt-Apple Shale Forest
17 O'Hares Creek Shale Forest*
18 Highlands Shale Tall Open Forest*
19 Transitional Shale Open Blue Gum Forest*
Shale Woodlands
20 Cumberland Shale Hills Woodland*
21 Cumberland Shale Plains Woodland*
22 Transitional Shale Dry Ironbark Forest*
23 Transitional Shale Stringybark Forest*
24 Highlands Alluvial Red Gum Woodland*
Sandstone Forests
25 Sandstone Gully Apple-Peppermint Forest
26 Sandstone Gully Peppermint Forest
27 Nepean Sandstone Gully Forest
28 Western Sandstone Gully Forest
29 Exposed Sandstone Scribbly Gum Woodland
30 Nepean Enriched Sandstone Woodland
31 Highlands Sandstone Scribbly Gum Woodland
32 Escarpment Edge Silvertop Ash Forest
33 Silvertop Ash Ironstone Woodland
34 Sandstone Heath-Woodland
35 Upper Georges River Sandstone Woodland
Mallees, Heaths and Scrubs
36 Budawang Ash Mallee Scrub
37 Dwarf Apple Heath
38 Rock Pavement Heath
39 Rock Plate Heath-Mallee
40 Woronora Tall Mallee-Heath
41 Highlands Sandstone Allocasuarina Heath
Swamps
42 Upland Swamps: Banksia Thicket
43 Upland Swamps: Tea Tree Thicket
44 Upland Swamps: Sedgeland-Heath Complex
45 Upland Swamps: Fringing Eucalypt Woodland
46 Upland Swamps: Mallee-Heath
47 Highlands Sandstone Swamp Woodland
48 Highlands Swamp Gum-Melaleuca Woodland
Other
49 Weeds and Exotics
50 Regenerating Vegetation
51 Artificial Wetlands
52 Water
53 Cleared
CAMPBELLTOWN
PICTON
APPIN
WOLLONGONG
SHELLHARBOUR
ROBERTSON
Map 10: Vegetation Communities
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3.3.1 Mapping Extant Vegetation Communities

A total of 53 landscape features have been mapped. Native vegetation communities are described and mapped by 48 Map Units. Table 8 indicates the total area of each Map Unit found within the Study Area and Map 10 shows the distribution over the same area, whereas Map 11 shows the broad community groups.

TABLE 8: MAP UNITS WITH AREA (HECTARES)

Map Unit	Vegetation Community Name	Area(ha)
MU1	Illawarra Escarpment Subtropical Rainforest	6.57
MU2	Coachwood Warm Temperate Rainforest	1380.43
MU3	Robertson Cool-Warm Temperate Rainforest	44.57
MU4	Sandstone Riparian Scrub	531.01
MU5	Cliffline Coachwood Scrub	1.88
MU6	Moist Blue Gum-Blackbutt Forest	832.75
MU7	Moist Coastal White Box Forest	6.76
MU8	Moist Gully Gum Forest	1202.29
MU9	Nepean Gorge Moist Forest	417.48
MU10	Robertson Basalt Brown Barrel Forest	505.50
MU11	Moist Shale Messmate Forest	726.75
MU12	Highlands Ribbon Gum Gully Forest	527.29
MU13	Tall Open Gully Gum Forest	1150.67
MU14	Tall Open Peppermint-Blue Gum Forest	1549.12
MU15	Tall Open Blackbutt Forest	968.99
MU16	Tall Blackbutt-Apple Shale Forest	24.55
MU17	O'Hares Creek Shale Forest	285.47
MU18	Highlands Shale Tall Open Forest	3435.25
MU19	Transitional Shale Open Blue Gum Forest	35.56
MU20	Cumberland Shale Hills Woodland	40.73
MU21	Cumberland Shale Plains Woodland	112.38
MU22	Transitional Shale Dry Ironbark Forest	1532.61
MU23	Transitional Shale Stringybark Forest	614.92
MU24	Highlands Alluvial Red Gum Woodland	92.62
MU25	Sandstone Gully Apple-Peppermint Forest	3962.95
MU26	Sandstone Gully Peppermint Forest	9994.77
MU27	Nepean Sandstone Gully Forest	7321.25
MU28	Western Sandstone Gully Forest	621.21
MU29	Exposed Sandstone Scribbly Gum Woodland	35964.20
MU30	Nepean Enriched Sandstone Woodland	5503.27
MU31	Highlands Sandstone Scribbly Gum Woodland	951.12
MU32	Escarpment Edge Silvertop Ash Forest	488.51
MU33	Silvertop Ash Ironstone Woodland	601.87

Map Unit	Vegetation Community Name	Area(ha)
MU34	Sandstone Heath-Woodland	408.89
MU35	Upper Georges River Sandstone Woodland	1950.23
MU36	Budawang Ash Mallee Scrub	12.17
MU37	Dwarf Apple Heath	12.34
MU38	Rock Pavement Heath	78.96
MU39	Rock Plate Heath-Mallee	822.07
MU40	Woronora Tall Mallee-Heath	547.44
MU41	Highlands Sandstone *Allocasuarina* Heath	59.41
MU42	Upland Swamps: Banksia Thicket	1120.03
MU43	Upland Swamps: Tea-tree Thicket	170.46
MU44	Upland Swamps: Sedgeland-Heath Complex	3448.64
MU45	Upland Swamps: Fringing Eucalypt Woodland	1579.95
MU46	Upland Swamps: Mallee-Heath	124.49
MU47	Highlands Sandstone Swamp Woodland	439.60
MU48	Highlands Swamp Gum-*Melaleuca* Woodland	144.23
49a	Acacia Scrub	362.09
49b	Turpentine Regeneration	81.39
49c	*Allocasuarina* Heath Regeneration	4.50
50	Weeds and Exotics	170.98
51	Cleared	8672.29
52	Artificial Wetlands	6.53
	Water	3385.47

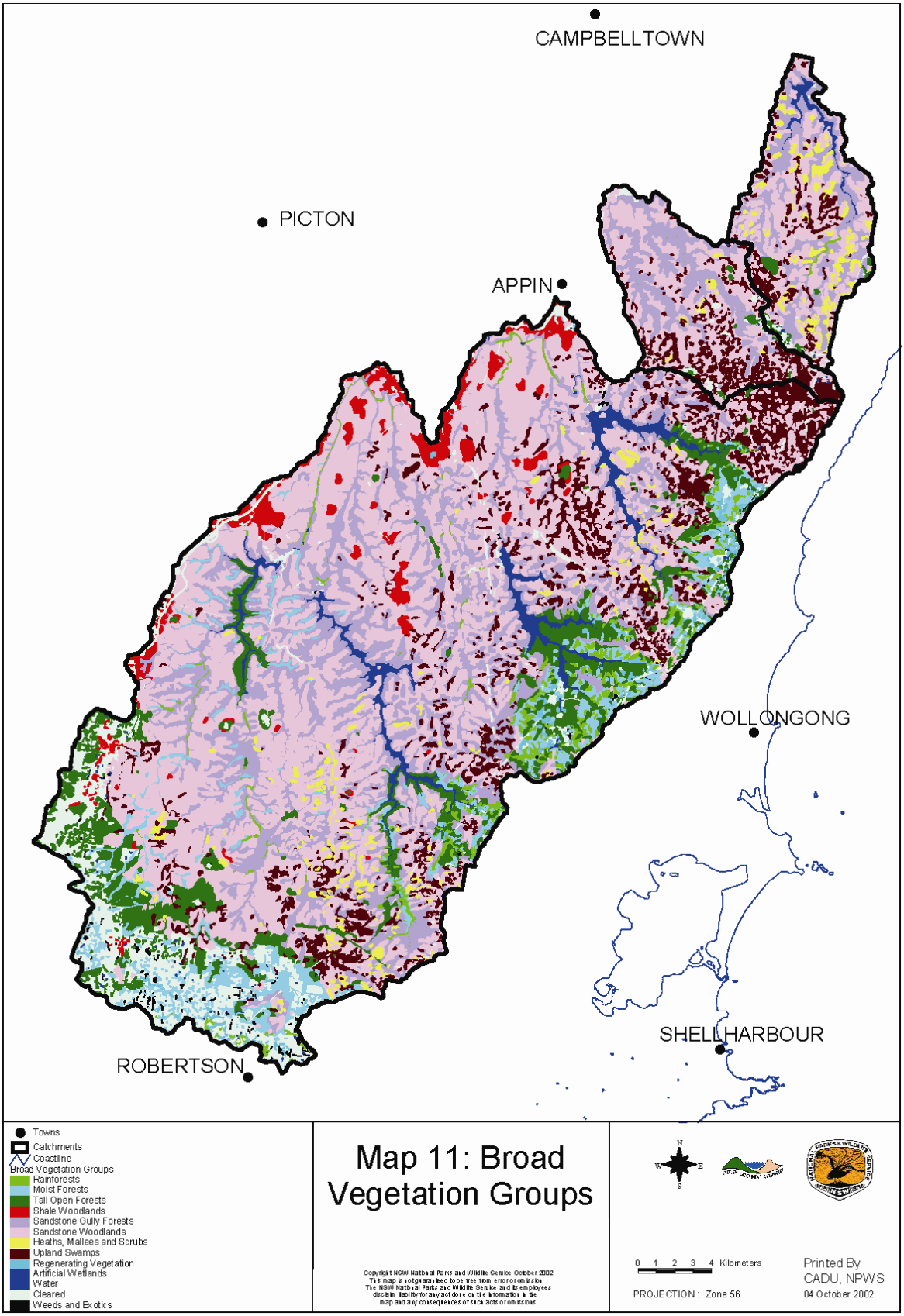
3.4 CONSERVATION STATUS

3.4.1 Disturbance Assessment

Some 83 percent of the Study Area displays limited evidence of disturbance from aerial photos. This is not surprising as much of the area has been protected as water catchment and never cleared. Evidence of heavy disturbance, including complete vegetation clearance, was observed across ten percent of the Study Area. This mainly occurs along the western, southern and eastern edges of the catchment. Higher fertility soils in these areas have been heavily cleared or modified for agricultural land use. A small area of vegetation (less than three percent) was identified as supporting moderate patterns of disturbance. Map 12 shows the distribution of disturbance intensity observable from aerial photographs. Table 9 illustrates the areal (hectares) and proportional (percentage) figures within the Study Area.

TABLE 9: AREA AND PROPORTION OF DISTURBANCE ASSESSMENT INDEX WITHIN THE STUDY AREA

Disturbance Intensity Index	Area (Hectares)	Proportion Study Area (%)
Low Disturbance (A Class)	87206.90	83.0
Moderate Disturbance (B Class)	2817.66	2.7
Heavy Disturbance (C Class)	802.04	0.8
Scattered Trees	1400.63	1.3
Weeds and Exotics	170.98	0.2
Acacia Scrubs, Turpentine Regeneration, *Allocasuarina* Heath Regeneration	447.98	0.4
Cleared	8672.29	8.3
Water	3385.47	3.2
Unassessed	144.48	0.1
Total	105348.45	100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PICTON
APPIN
WOLLONGONG
SHELLHARBOUR
ROBERTSON
Towns
Catchments
Coastline
Broad Vegetation Groups
Rainforests
Moist Forests
Tall Open Forests
Shale Woodlands
Sandstone Gully Forests
Sandstone Woodlands
Heaths, Mallees and Scrubs
Upland Swamps
Regenerating Vegetation
Artificial Wetlands
Water
Cleared
Weeds and Exotics
Map 11: Broad Vegetation Groups
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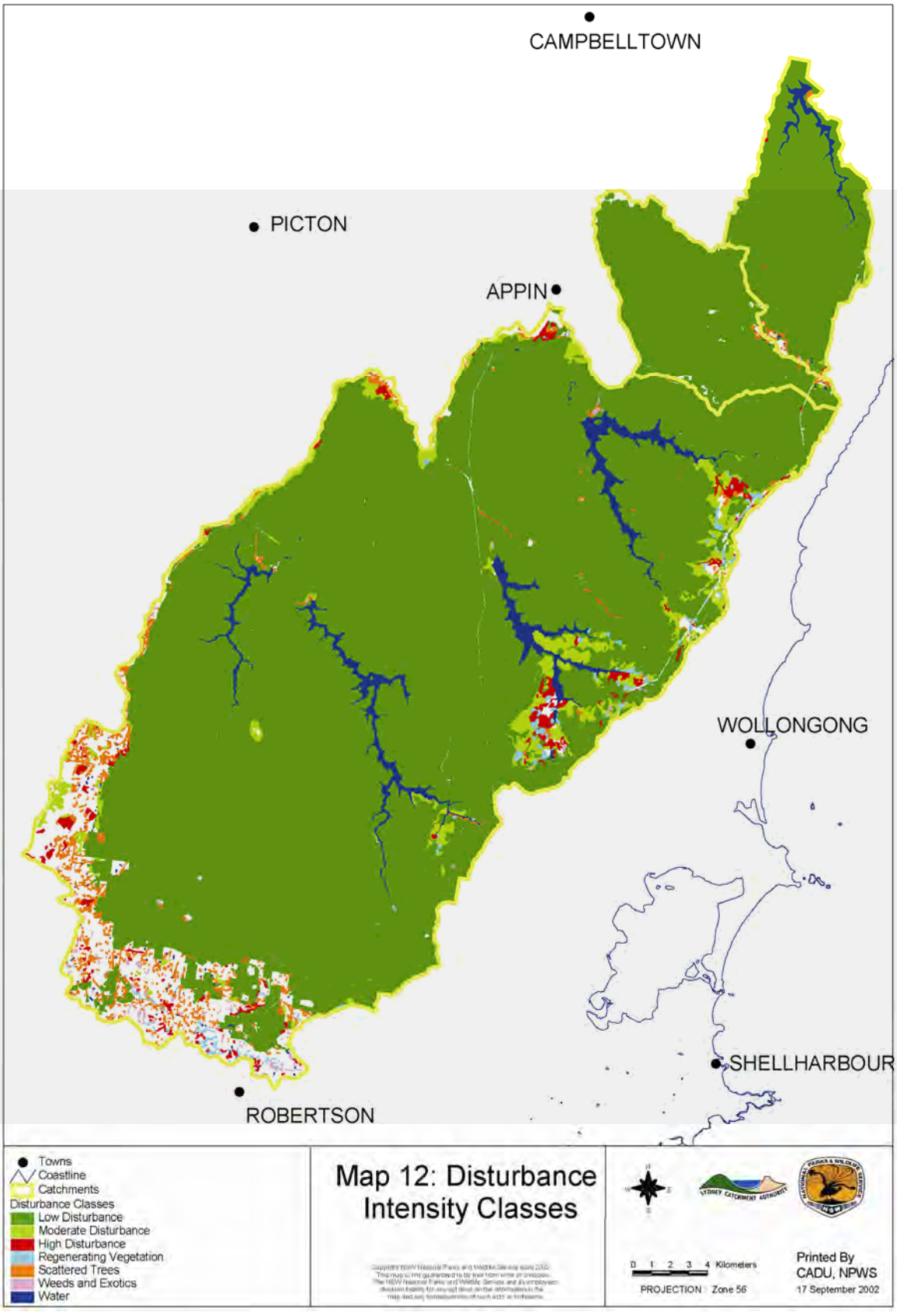
CAMPBELLTOWN
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WOLLONGONG
SHELLHARBOUR
ROBERTSON
Towns
Coastline
Catchments
Disturbance Classes
Low Disturbance
Moderate Disturbance
High Disturbance
Regenerating Vegetation
Scattered Trees
Weeds and Exotics
Water
Map 12: Disturbance Intensity Classes
0 1 2 3 4 Kilometers
PROJECTION : Zone 56
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4 DISCUSSION

4.1 PATTERNS IN VEGETATION COMMUNITIES

The following discussion summarises the hierarchal structure of vegetation patterns derived from field site data (Figure 2). A number of additional vegetation communities that have been described from existing studies (NPWS, 2000d; 2002) and have not been shown in Figure 2 are also discussed.

4.1.1 Shale-Sandstone Transition Forests and Woodlands

Extensive areas of Transitional Shale Dry Ironbark Forest (Map Unit 22) or "Bargo Brush" occurs on elevations less than 400 metres on residual shale soils that overlie sandstone bedrock along the western boundary of the Special Areas. The drier environment in combination with the richer shale soil results in a grassy woodland and open forest that marks the gradual transition into the vegetation of the Cumberland Plain. However, NPWS (2000d) notes that as the margins of the shale approach the sandstone geology the thickness of shale stratum diminishes, resulting in an influence of sandstone in the underlying soil. This results in a combination of species that mark the transition between a shale and a sandstone substrate. The canopy is often dominated by Ironbarks (*Eucalyptus crebra, E. paniculata* subsp. *paniculata* and *E. fibrosa*) and Stringybarks (*E. globoidea* and *E. eugenioides*). *Eucalyptus punctata* is also frequently recorded. The understorey is grassy, not unlike the Shale Plains Woodland (Map Unit 21). However, in areas where sandstone influence in the soil is greater a more pronounced shrub layer is present that includes species such as *Banksia spinosa* var. *spinosa*, *Persoonia linearis* and *Kunzea ambigua*. The boundaries between high and low sandstone influences are not abrupt. Higher sandstone influences are most often found on the outer bands of the residual shale caps and may be marked by an increased abundance of Stringybark species such as *Eucalyptus globoidea* and trees more typical of sandstone soils such as *Corymbia gummifera* and *E. sclerophylla*. The vegetation community found in these zones has been identified as Transitional Shale Stringybark Forest (Map Unit 23).

Both of these communities form a component of Shale Sandstone Transition Forest listed on Part 3 of Schedule 1 of the NSW Threatened Species Act (1995).

4.1.2 Elevated Mittagong Sandstone Woodland-Heath

In the far south west of the Study Area, temperatures are distinctively cooler. Here a sandstone woodland occurs which has the typical canopy species, though it is mainly dominated by *Eucalyptus sclerophylla*. *Eucalyptus mannifera* subsp. *mannifera* and *E. radiata* subsp. *radiata* are also found occasionally, particularly in minor depressions that form frost hollows. The shrub layer is comprised of *Banksia spinulosa* var. *spinulosa*, *Hakea dactyloides* and *Isopogon anemonifolius.* The ground cover can support a mix of tussock grasses that include *Poa labillardieri* var. *labillardieri* and *Joycea pallida*. This community has been called Highlands Sandstone Scribbly Gum Woodland (Map Unit 31).

A unique low growing heath occurs on Mittagong Sandstone (Benson & Howell, 1994) near the junction at Racecourse. Highlands Sandstone Allocasuarina Heath (Map Unit 41) features a dense shrub layer of *Allocasuarina diminuta* subsp. *mimica* and *A. paludosa* in combination with species such as *Banksia spinulosa* var. *spinulosa* and *Hakea dactyloides.* The distribution of this community is not well known with only a few disjunct locations known from the Sydney Basin Bioregion.

4.1.3 Scrubs on Sandy Alluvium

Alluviums derived from siliceous sandstone rock support low growing shrubs that form dense thickets and scrubs. Amongst the upland swamps, minor drainage lines are found in the gentle depressions. Upland Swamps: Tea-tree Thicket (MU43) occurs where underlying soils are waterlogged and is comprised of *Leptospermum juniperinum, Melaleuca squarrosa, Gahnia sieberiana* and *Gleichenia* spp. Riparian Scrubs (Map Unit 4) are also found on sandy deposits, however, these drainage lines are more sheltered and contain a greater mesic component in the shrub layer. As a result this community has been included in the discussion on rainforests (Section 4.1.5).

4.1.4 Tall Open Forests on Enriched Soils

Tall open forests are found on more fertile soils associated with fine-grained sedimentary rock such as the Narrabeen series, Wianamatta shale and Tertiary basalt flows and intrusions. These forests are characterised by tall Eucalypts and a sparse shrub and small tree layer. Ground cover is generally dense with the prominent *Lomandra longifolia* common and herb and grass species also abundant

On the mid to upper slopes of Narrabeen Sandstone derived soils, a tall open forest develops. The characteristic feature of the vegetation is the understorey, a dense cover *of Lomandra longifolia, Pteridium esculentum, Calochlaena dubia* and *Entolasia stricta.* The shrub layer comprises a mix of sclerophyllous sandstone heath species such as *Persoonia linearis* and *Banksia spinulosa* var. *spinulosa*, as well as shrubs that prefer moister locations such as *Leucopogon lanceolatus* var. *lanceolatus, Elaeocarpus reticulatus* and *Notelaea longifolia*. *Eucalyptus piperita* and *Acacia binervata* are the most consistent tree species, although they may be absent at wetter sites where *E. pilularis* dominates. *Eucalyptus pilularis* is a regular associate species in the Cataract Catchment (Tall Open Blackbutt Forest - Map Unit 15). Tall Open Peppermint-Blue Gum Forest (Map Unit 14) occurs on exposed locations on valley slopes and crests north of Mt. Kembla with *Eucalypt piperita* and *E.saligna* (incl *E. salignaXbotryoides)* in combination with *E. globoidea* and *E. cypellocarpa.* South of Mt. Kembla, crests and exposed slopes comprise tall *Eucalyptus smithii*, *E. piperita*, *E. muelleriana* and *E. cypellocarpa* are more common (Map Unit 13).

Residual chocolate shale soil associated with the Narrabeen Group Geology can remain in exposed locations such as crests or gentle north facing slopes. Species that grow here form a complex that is not dissimilar to that which grows on the red podsolic soils derived from the Wianamatta Shale. There is an absence of sclerophyllous shrubs. Instead a moist herb and grass layer becomes more pronounced and diverse. While *Lomandra longifolia* and *Pteridium esculentum* still dominate, moisture-loving herbs such as *Pratia purpurascens, Dichondra repens, Pseuderanthemum variable, Viola hederacea* and *Desmodium varians* are all present. *Eucalyptus piperita* is less frequent from these sites and *E saligna*, *E. salignaXbotryoides* or *E. pilularis* are more likely to dominate.

An interesting patch of *Eucalyptus salignaXbotryoides* occurs on a remnant shale soil in the western Cataract Catchment. It is unusual in that rainfall is considerably lower here than other areas that support a tall Blue Gum Forest. The understorey is characterised by a grassy and herbaceous understorey that resembles Transitional Forests found closer to the interface with the Cumberland Plain. Hence, this community has been described as Transitional Shale Open Blue Gum Forest (Map Unit 19). All Transitional Forests form a component of the Shale Sandstone Transition Forest, an Endangered Ecological Community listed under the Threatened Species Conservation Act, 1995.

Wianamatta Shale capping also occurs within the Woronora and O'Hares Catchments in the north of the Study Area. The rainfall is higher here and a tall open forest of *Eucalyptus piperita, E. globoidea* and *Angophora costata* develops on the flat cappings. The understorey is open with ferns, grasses and *Doryanthes excelsa* marking a distinctive assemblage from the surrounding sandstone vegetation. This community is known as the O'Hares Creek Shale Forest (Map Unit 17) and is also listed as an Endangered Ecological Community. Like many of the shale communities the understorey can include a number of species from the Proteaceae and Fabaceae families, depending on the degree of intermixing with surrounding sandstone material.

Further east at Helensburgh and in Royal National Park, the rainfall is again higher providing a suitable habitat for tall *Eucalyptus pilularis, Syncarpia glomulifera* subsp. *glomulifera*, *E. piperita* and *Angophora costata* (Tall Blackbutt-Apple Shale Forest - Map Unit 16). A similar understorey is present to that found in the O'Hares Creek Shale Forest although the greater moisture levels can support rainforest species such as *Livistona australis*. *Eucalyptus globoidea* is not present in Tall Blackbutt-Apple Shale Forest.

Elevation is considerably higher in the south of the Study Area and cooler temperatures result. On the shale derived soils of the southern Nepean Catchment a tall open forest (Map Unit 18) grows on the shallower shale soils that still support a sandstone influence. *Eucalyptus piperita* is still present with *E. radiata* subsp*. radiata* and *E. globoidea*. A shrub layer of *Acacia binervata* and *A. longifolia* subsp. *longifolia* is present along with other typical sandstone shrubs that include Banksias, Hakeas and Geebungs. Grasses are also common, with *Poa sieberiana* var. *sieberiana* and *Entolasia marginata*, along with the rush *Lomandra longifolia*.

The western extent of the southern shale supports a different suite of canopy species. *Eucalyptus quadrangulata* and *E. elata* are more frequent along with *E. punctata*. This combination of canopy species

retains the same characteristic understorey and occurs along the slopes of the Burke River and near Aylmerton. Also near Aylmerton, alluvial plains feature remnants of woodlands dominated by *Eucalyptus amplifolia* subsp. *amplifolia* (Highlands Alluvial Red Gum Woodland - Map Unit 24). This map unit as been heavily disturbed, with existing areas subject to continued grazing pressures on private land.

Drainage lines on shale soil in the far south west of the Study Area support large *Eucalyptus viminalis* and *E. elata.* This community has been classified Highlands Ribbon Gum Gully Forest (Map Unit 12). Further sampling is required to clarify the composition of this community. However, it appears that it is most prevalent on shale soil or sandstones that have been enriched by shale material. Understorey species are typical of gully habitat, and include *Lomandra longifolia* as the dominant ground cover and *Pittosporum undulatum* and *Acacia binervata* as the prominent shrub species.

On the deeper shale soils in these high elevations and in the higher rainfall band closer to the escarpment edge a very tall open forest (reaching 40 metres) develops (Moist Shale Messmate Forest - Map Unit 11). It is composed of *Eucalyptus obliqua, E. piperita, E. cypellocarpa* and *E. globoidea*. The understorey is again grassy and can include a low abundance of distinctive treeferns, including *Cyathea australis*. Moister gradients will include species such as *Acmena smithii*, *Coprosma quadrifida* and *Acacia binervata.*

These southern shale forests also are characterised by gently sloping drainage lines and depressions. These areas tend to form ephemeral soaks during periods of heavy rain. The swampy features support a high abundance of *Eucalyptus ovata* often in association with very dense thickets of *Melaleuca linariifolia* (Highlands Swamp Gum-*Melaleuca* Woodland - Map Unit 48). The understorey shares a similar dense ground cover of *Lomandra longifolia*, *Dianella caerulea* and *Poa sieberiana* var. *sieberiana*. It may also feature sedge and swamp species common to upland swamps on sandstone, including *Schoenus melanostachys*. It is also interesting to note that this community occupies sites where geology appears to change from shale to basalt. It may be that ground water discharge is present at this interface. Clearing has removed extensive areas of these forests on depressions and drainage lines of the margins of the Robertson Plateau.

The Basalt soils on the Robertson Plateau have all but been cleared for agriculture. Only small, heavily disturbed patches of the once tall forests and rainforests found on these soils remain. The rainforests (Map Unit 3) that are likely to have once been extensive have previously been described in Section 4.1.5. Remnants are concentrated in areas above 1300 millimetres mean annual rainfall. The Eucalypt forests are described from a few isolated localities where tall to very tall *Eucalyptus fastigata, E. cypellocarpa*, *E. quadrangulata* and *E. obliqua* have been recorded. This community has been titled Robertson Basalt Brown Barrel Forest (Map Unit 10). Majestic examples of *E. fastigata* line some roadsides between Robertson and East Kangaloon. On presently available data, understorey varies between a grassy forest dominated by *Poa labillardieri* var. *labillardieri* and one characterised by moist shrubs such as *Coprosma quadrifida, Dicksonia antarctica* and *Alectryon subcinereus.*

At Upper Cordeaux Reservoir, the Cordeaux Crinanite has suffered from a similar level of clearing. Once a thriving agricultural village, the area has almost entirely been resumed into the management of the Sydney Catchments Authority. While this area receives an equally high level of rainfall (over 1600 millimetres per year) as the eastern Robertson Plateau, it is around half the elevation (350-400 metres). As a result the vegetation consists of different combinations of species to the higher plateau. Firstly, the Cordeaux Crinanite supports the only areas of Subtropical Rainforest in several of the incised creeklines. Thomas (1990) infers that this rainforest may once have been more extensive, with large isolated *Toona ciliata* still present in the upper catchment.

Regenerating *Eucalyptus salignaXbotryoides and E. piperita* (Map Unit 14) forests are found in remnant riparian vegetation on the fringe of cleared paddocks. These remnants are floristically simple with a ground cover of *Lomandra longifolia, Dichondra repens, Pteridium esculentum, Entolasia stricta* and *E. marginata*. *Acacia binervata* forms an occasional small tree layer. An interesting patch of Red gums (*Eucalyptus amplifolia* subsp. *amplifolia* and *E. tereticornis*) occurs at the crossing of Cordeaux Creek between Cordeaux number 1 and number 2 dams. There are only two patches of this community remaining on the Crinanite and may mark subtle changes in geology with the Narrabeen Sandstones and Shales. The understorey is similarly dominated by *Lomandra longifolia,* although the sample site supported *Gahnia sieberiana* and *Juncus continuus* amongst typical herbs and grasses. This community has not identified as a separate community and it awaits further investigation.

A Cupitts Forest and Izards Knob are volcanic necks that rise to around 500 metres above the Burke and Nepean Rivers. These isolated fertile soils have also been cleared for agricultural activities. On the areas of deepest soil *Eucalyptus tereticornis* appears to be the dominant eucalypt above a cover of grasses that includes *Poa sieberiana* var. *sieberiana* and *Entolasia marginata*. *Eucalyptus quadrangulata* is present on the side slopes along with *E. elata* on protected aspects. These areas have been included within Map Unit 18. As the volcanic soil thins a clearly observable transitional forest dominated by *Eucalyptus globoidea* and *E. punctata* with sandstone shrub species found amongst the understorey. This transitional vegetation forms a concentric outer ring to the more fertile soils and has been included within Map Unit 23.

Mt. Cotopaxi, at just over 630 metres in elevation, supports a modest area of volcanic material resulting from a trachyte intrusion. The coarse sediments produce a vegetation community that forms part of the enriched sandstone complex. A tall forest of *Eucalyptus piperita* and *Corymbia gummifera* grows on an exposed crest with a mixed sandstone shrub stratum that includes *Banksia spinulosa* var. *spinulosa* and a prominent ground cover of *Lomandra longifolia, Pteridium esculentum* and *Patersonia sericea*. These trachyte forests are included within Map Unit 30.

4.1.5 Rainforests and Tall Moist Eucalypt Forests

Rainforests

Thomas (1990) documented the distribution and composition of rainforest types found in the Metropolitan and Woronora Catchments. His conclusions have been supported by additional fieldwork completed from new floristic data collected and compiled for this project. As Thomas (1990) indicates, rainforests are mostly condensed within an area less than five kilometres from the Illawarra escarpment. At these locations rainfall remains high, generally above 1200 millimetres per year, and the soils provide suitable nutrient supply from either the Narrabeen Shale or the richer basalt rocks found on the Robertson Plateau or Upper Cordeaux area. In addition, the depth of the gullies that accompany the Narrabeen Geology provide suitable protection from prevailing winds and warm summer sun to ensure that soil moisture is retained. Poorly structured mesic scrubs with rainforest affinities are found in a number of different environments. On infertile Hawkesbury Sandstones, riparian scrubs develop in narrow ribbons at the base of gorges. They are also found on the clifflines of the Illawarra escarpment in highly exposed locations, buffeted by prevailing south easterly winds.

Subtropical influenced rainforest stands are very limited in the catchments. They are restricted to a number of deeply incised creeklines in the Cordeaux Catchment, found growing on rich igneous material known as Crinanite. *Dendrocnide excelsa, Diploglottis australis, Doryphora sassafras*, *Toona ciliata* and *Cryptocarya* spp. are characteristic amongst the tree species. Subtropical rainforest found in these locations share a similar floristic composition to those found on the Illawarra Escarpment benches and gullies and have been identified within the same name (Map Unit 1). Thomas (1990) makes reference to the opinions of a long time resident of the Cordeaux Catchment who suggests that both *Toona ciliata* and *Dendrocnide excelsa* were far more extensive than they are in the present day. Selective logging and past clearing for agriculture are likely causes of such a decline, although it is unlikely that this type of rainforest was ever extensive above the escarpment.

Warm Temperate Rainforest (Map Unit 2) is the most extensive rainforest community within the catchments. Two species, *Ceratopetalum apetalum* and *Doryphora sassafras* dominate the canopy, often with *Acmena smithii.* This type of rainforest dominates the deeply incised gullies and sheltered slopes in high rainfall areas on Narrabeen Shales and Sandstones. There are variations within the community that respond to moister or drier sites as well as to elevational gradients. Warm Temperate Rainforest in the Avon Catchment may include some species such as *Eucryphia moorei* or *Quintinia sieberi* that highlight the gradual transition into cool temperate climates. At other moister sites at lower elevations species such as *Sloanea australis, Pennantia cunninghamia* and *Schizomeria ovata* can be found amongst the canopy. A number of areas of Coachwood Warm Temperate Rainforest support sites of limited diversity. These depauperate sites are often the result of significant past disturbance resulting from fire, clearing or grazing in the Cordeaux and Cataract Catchments. In some deeply dissected gorges in the Nepean Catchment, small stands of Warm Temperate Rainforest occur. Species composition is less diverse owing to the much reduced rainfall on the western side of the catchment.

Robertson Cool-Warm Temperate Rainforest (Map Unit 3) is the name given to the rainforest that occurs on the high elevation basalt soils of the Robertson Plateau. *Doryphora sassafras*, *Quintinia sieberiana*

and *Acmena smithii* are found in the canopy with *Coprosma quadrifida, Polyosma cunninghamii* and *Hedycarya angustifolia* forming a subcanopy. This rainforest type is thought to have once been extensively distributed across the basalt plateau. With much of it now cleared and few areas located in formal reserves it has been listed as an Endangered Ecological Community under the Threatened Species Conservation Act, 1995. Most is located on private land within the catchment, although one stand is protected at Macquarie Hill above Macquarie Pass.

Riparian Scrub (Map Unit 4) is a very simple rainforest community that mixes elements of Warm Temperate Rainforest species with sclerophyllous shrubs. It is mainly restricted to gully lines and gorges of Hawkesbury Sandstone. Generally a low scrub, this community comprises *Tristaniopsis laurina, Backhousia myrtifolia, Ceratopetalum apetalum* and *Allocasuarina littoralis*. Shrubs *of Tristania neriifolia, Lomatia myricoides* and *Acacia obtusifolia* are typical. A dense cover of ground ferns, such as *Sticherus flabellatus* var. *flabellatus*, may occur. Composition of the community varies depending on exposure. A closely related assemblage occurs on clifflines of the Illawarra escarpments (Map Unit 5), described in Section 4.1.9.

Tall Moist Eucalypt Forests

On the chocolate shale soils of the Narrabeen series in deeply protected topographic positions, such as incised gullies and southerly aspects, tall stands of Coachwood Warm Temperate Rainforest (Map Unit 2) form patches that are rarely larger than ten hectares (Thomas, 1990). In less favourable locations a tall moist eucalypt forest develops on the fringe of the rainforest. In the Cataract Catchment this forest is most often typified by *Eucalyptus salignaXbotryoides, Syncarpia glomulifera* subsp. *glomulifera* and *E. pilularis.* Moist Blue Gum-Blackbutt Forest (Map Unit 6) has a well developed moist shrub layer that includes species such as *Doryphora sassafras, Acmena smithii, Tasmannia insipida* and *Livistona australis*. In the Avon and Cordeaux Catchments, additional tree species can include *Eucalyptus smithii, E. elata, E. muelleriana* and *E. cypellocarpa* (Moist Gully Gum Forest - Map Unit 8). These forests are characterised by the diverse combination of warm temperate rainforest species that dominate the small tree layer. Map Unit 8 is also found on the igneous Crininanite soils that form a mini-scarp to the west of the Cordeaux valley. The elevation rises from around 315 metres in elevation to almost 500 metres at the top of the scarp. The scarp is relatively steep and a tall moist forest of *Eucalyptus quadrangulata, E. smithii*, *E. muelleriana* and *E. salignaXbotryoides* are found above *Acmena smithii, Doryphora sassafras* and *Cryptocarya* spp. Gullylines running down the scarp support regenerating Coachwood Warm Temperate Rainforest (Map Unit 2).

In the Nepean Catchment conditions are drier and the soil material is derived from Hawkesbury and Mittagong bedrock. In the deepest east-west running gorges, Nepean Gorge Moist Forest (MU9) carries a well developed mesic subcanopy and shrub layer though this is considerably simpler than the moist forests to the east. Tree species tend to include *Eucalyptus elata, E. punctata* and *E. agglomerata* with *Cerapetalum apetalum* and *Backhousia myrtifolia* forming the subcanopy layer. Species such as *Cryptocarya glaucescens*, *Livistona australis* and *Synoum glandulosum* subsp. *glandulosum* are common to the eastern moist forests but no longer occur in the drier locations associated with Nepean Gorge Moist Forest.

4.1.6 Exposed Sandstone Woodlands and Heath

The dry open woodlands that occur on the sandstone plateau are the most extensive vegetation complex of the catchments. Early explorers described the Woronora Plateau as a “barren wasteland, of little use to anyone” and a “nuisance” (Young and Young, 1988). Such a classification is understandable as the country features highly acidic, infertile and shallow sandy soils which afforded no opportunities for agricultural pursuits. However, these environments support a highly diverse flora.

There are some distinctive patterns in the species assemblages that appear to respond to gradual changes in rainfall as it decreases from east to west and in elevation as it rises from north to south. There are also patterns that arise from geological changes, where laterites and ironstones characterise environments in the north east and where Mittagong Formation Sandstones dominate Hawkesbury Sandstones in the western band of the Study Area.

Table 10 provides a comparison between the frequency of occurrence for selected species across the sandstone woodlands. The eastern edge of the catchments, from south to north receives high levels of annual rainfall. Under these conditions the sandstone woodland comprises a typical overstorey of

Corymbia gummifera, Eucalyptus racemosa and *E. sieberi*. At times *Eucalyptus sieberi* may dominate completely. The Stringybark *Eucalyptus oblonga* is infrequently recorded. The heath layer is diverse and dense, with *Banksia serrata, B. ericifolia* subsp. *ericifolia, Leptospermum trinervium* and *Acacia suaveolens* characteristic. As the rainfall level falls below 1000 millimetres per year, *Eucalyptus oblonga* becomes more frequent in the canopy and *E. sieberi* becomes less prominent. The heathy understorey becomes less diverse with *Banksia spinulosa* var. *spinulosa* replacing *B. ericifolia* subsp. *ericifolia* as the dominant Banksia species. *Banksia serrata* is also less frequently recorded. *Cyathochaeta diandra, Lomandra cylindrica* and *L. obliqua* are the dominant ground covers. These changes are gradual and have been mapped as one complex Exposed Sandstone Scribbly Gum Woodland (Map Unit 29)

In the Nepean Catchment, a sandstone woodland (Nepean Enriched Sandstone Woodland - Map Unit 30) occurs on soils derived from the Mittagong Formation geologies. The interbanding stratum of shale and sandstone produces enriched sandstone results in a taller woodland with a less abundant and less diverse shrub layer. *Banksia spinulosa* var. *spinulosa, Bossiaea obcordata, Persoonia levis* and *Acacia terminalis* comprise the shrub layer while the ground supports a greater cover of grasses such as *Entolasia stricta* and *Austrostipa pubescens*, and the herb *Patersonia sericea.*

TABLE 10: FREQUENCY OF OCCURRENCE (%) OF SELECTED SPECIES ACROSS SANDSTONE WOODLANDS OF THE STUDY AREA. GROUP DATA HAS BEEN DERIVED FROM TRANSFORMED PRESENCE AND ABSENCE DATA USING BRAY-CURTIS COEFFICIENT

Species	**Royal National Park(n=29)**	**Exposed Sandstone Scribbly Gum Woodland (Eastern form) (n=56)**	**Exposed Sandstone Scribbly Gum Woodland (Western form) (n=31)**	**Nepean Enriched Sandstone Woodland (n=27)**	**Highlands Sandstone Scribbly Gum Woodland (n=3)**
Map Unit Number	**Not Mapped**	**MU29**	**MU29**	**MU30**	**MU31**
Trees					
Corymbia gummifera	79	88	100	87	NP*
Eucalyptus racemosa/ sclerophylla/ haemastoma	63	68	70	62	100
Eucalyptus sieberi	34	68	53	62	16
Eucalyptus oblonga	NP*	22	65	50	NP*
Eucalyptus globoidea	NP*	22	2	37	10
Eucalyptus piperita	31	48	3	62	NP*
Angophora costata	44	NP*	NP*	NP*	NP*
Shrubs					
Acacia suaveolens	65	88	45	1	NP*
Acacia terminalis	NP*	37	30	68	16
Banksia ericifolia subsp. *ericifolia*	87	82	NP*	1	NP*
Banksia marginata	68	25	NP*	NP*	NP*
Banksia serrata	97	100	45	NP*	NP*
Banksia spinulosa var. *spinulosa*	34	57	100	100	100
Hakea dactyloides	65	74	60	31	100

Species	Royal National Park(n=29)	Exposed Sandstone Scribbly Gum Woodland (Eastern form) (n=56)	Exposed Sandstone Scribbly Gum Woodland (Western form) (n=31)	Nepean Enriched Sandstone Woodland (n=27)	Highlands Sandstone Scribbly Gum Woodland (n=3)
Map Unit Number	**Not Mapped**	**MU29**	**MU29**	**MU30**	**MU31**
Isopogon anemonifolius	82	77	90	NP*	50
Lambertia formosa	79	82	90	43	NP*
Leptospermum trinervium	100	94	90	62	16
Petrophile pulchella	86	57	55	62	NP*
Persoonia levis	76	85	90	93	NP*
Ground					
Actinotus minor	63	65	NP*	12	12
Caustis flexuosa	50	88	45	18	18
Cyathochaeta diandra	50	22	85	81	59
Dampiera stricta	42	77	25	50	50
Doryanthes excelsa	50	NP*	NP*	NP*	NP*
Entolasia stricta	57	31	65	87	83
Lepyrodia scariosa	NP*	82	30	31	65
Lepidosperma laterale	68	45	NP*	12	83
Lomandra glauca	55	71	30	NP*	50
Xanthorrhoea media	92	37	NP*	NP*	NP*

NP* Not Present

This contrasts to the environments of the northern catchments that occupy lower elevations and are generally warmer. North of Appin Road, the catchments of Woronora River and O'Hares Creek lie on remnants of an extensive lateritic mantle. These rocks have been termed ironstone and have been used to delineate a variant of the sandstone woodlands known as Silvertop Ash Ironstone Woodland (Map Unit 33) based on work by Keith (1994). Ironstone provides a richer red-yellow ochre soil than the bleached siliceous soils of typical sandstone. *Eucalyptus sieberi* is often the most dominant species in this assemblage, with other typical sandstone woodland trees infrequent. The understorey is marked by the presence of the lily *Doryanthes excelsa*, amongst the shrub species typical of sandstone woodlands.

These ironstone mantles also appear to influence a number of other vegetation communities in this area. On the broad flat plateaux of both Woronora and O'Hares Catchments the soil is often deep sand with a thin highly fragmented mantle of ironstone. This produces very low open woodland with a very dense and diverse heath understorey. The tree canopy has typical species (*Corymbia gummifera, Eucalyptus sclerophylla*) albeit in stunted form. A heath comprised of *Petrophile pulchella, Grevillea oleoides, Hakea dactyloides, Banksia ericifolia* subsp. *ericifolia, B. serrata* and *Isopogon anemonifolius* occurs with *Actinotus minor, Dampiera stricta* and *Lepyrodia scariosa* prominent ground covers. Dwarf Apple Heath (Map Unit 37) forms a low open heath with scattered *Eucalyptus sclerophylla* and *Corymbia gummifera* occurring in the low open canopy. *Angophora hispida* distinguishes this from other heath types. It occurs with other species such as *Leptospermum trinervium, Petrophile sessilis, Hakea dactyloides, Banksia oblongifolia* and *Pultenaea elliptica*.

Upper Georges River Sandstone Woodland (Map Unit 35) represents another enriched sandstone environment occurring in the western band of the northern Catchments. Again the Mittagong Sandstone formations provide the interbanding shale influence in the soil that supports a canopy dominated by *Corymbia gummifera, Eucalyptus punctata*, *E. sclerophylla* and stringybarks from the *E. oblonga/globoidea/eugenioides* complex. Unlike other woodlands, Banksias are not prominent in this assemblage with shrub species more often comprising *Acacia ulicifolia, A. terminalis, Leptospermum trinervium* and *Persoonia linearis*. Grasses including *Entolasia stricta*, *Austrostipa pubescens* and *Themeda australis* often dominate the ground cover.

Sandstone ridgetops also support areas of Mallee-Heath. These comprise a very similar combination of heath and ground cover species to woodlands, although the structure of the vegetation is characterised by low open cover of mallee trees. In the Woronora and O'Hares Catchments, *Eucalyptus luehmanniana* is the most frequent and prominent. It is found amongst rock outcrops at the end of north facing spurs and also on sandstone ridgetops where massive rock plates occur beneath the skeletal sandy soil. To the south, dramatic sandstone tors outcrop in the Avon and Cordeaux Catchments. Mallees here are either *Eucalyptus apiculata* or *E. stricta* with a shrub layer of *Leptospermum arachnoides, L. trinervium, Hakea dactyloides* and *Banksia ericifolia* subsp. *ericifolia*.

4.1.7 Sandstone Gully Forests

Four Sandstone Gully Forests have been described. These sheltered forests follow distribution trends found amongst the ridgetop woodlands. In the northern catchments of Woronora River and O'Hares Creek, two sandstone gully forests have been previously described (Keith, 1994). In the east, two tree species (*Angophora costata* and *Eucalyptus piperita*) dominate. Tall shrubs of *Banksia serrata* and *Ceratopetalum gummiferum* rise above a lower shrub layer of Banksias, Hakeas and Wattles. The ground often supports a dense cover of *Doryanthes excelsa* amongst other species such as *Lomandra longifolia* and *Pteridium esculentum*. As the forest descends closer to the creekline, the understorey can become a matting of *Gleichenia* species and *Bauera rubioides*, and may include *Ceratopetalum apetalum* in the shrub layer. This community, Sandstone Gully Apple-Peppermint Forest (MU25), extends to the north east of the Holsworthy Military Area, through Heathcote National Park and is extensive in Royal National Park.

Changes in rainfall and elevation result in a slightly different gully assemblage (Western Sandstone Gully Forest - Map Unit 28) in the west of the O'Hares Creek Catchment. In areas where rainfall is less than 1050 millimetres per year the forest is dominated by *Angophora costata, Eucalyptus punctata, E. pilularis, E. agglomerata* and *Corymbia gummifera* (NPWS, 2000b). A sparse small tree layer of *Allocasuarina littoralis* and *Ceratopetalum gummiferum* occurs above *Acacia terminalis, Leptospermum trinervium* and *Persoonia linearis*. This community grades into Upper Georges River Sandstone Woodland on upper slopes. It features in the gully lines of the Georges River and lower Cataract River.

South of Appin Road, between the O'Hares and Cataract Catchments, there is another change which marks a north-south gradient along the Study Area. Two conspicuous species (*Angophora costata* and *Doryanthes excelsa*) no longer occur in the gullylines and sheltered environments and the forest is dominated by tall *Eucalyptus piperita*, *Corymbia gummifera, E. sieberi, E. globoidea* and *E. agglomerata*. Shrub layers remain relatively consistent between the north and southern catchments, although *Banksia serrata* is not as prominent. While primarily a gully and sheltered slope community, the combination of species found in Sandstone Gully Peppermint Forest (Map Unit 26) are sometimes found in exposed locations such as upper slopes and crests where rainfall levels are exceptionally high. Examples of this are found in areas close to the escarpment edge.

Amongst the higher elevations in the Nepean and western Cordeaux Catchments another variation in sandstone gully forest emerges (Nepean Sandstone Gully Forest - Map Unit 27). Occurring in proximity to Mittagong Formation Sandstone, this tall forest is comprised of *Eucalyptus piperita, E. agglomerata, E. punctata* and *E. sieberi*. Small trees of *Allocasuarina torulosa* and *A. littoralis* are found. *Elaeocarpus reticulatus, Leucopogon lanceolatus* var. *lanceolatus, Banksia spinulosa* var. *spinulosa, Ceratopetalum gummiferum* and *Persoonia linearis* mark the moderately dense shrub layer. Like Map Unit 28, it occurs on the deeply dissected gorges of the western Study Area and as a result share many species. The grade between the two map units is most notable south of Broughtons Pass in the Cataract Catchment, where *Eucalyptus pilularis* no longer occurs.

4.1.8 Upland Swamp Complex

The Upland Swamp Complex found on the Woronora Plateau is one of the more distinctive vegetation features. The extensive areas of treeless heaths and sedgelands found at locations such as Maddens Plains provide a dramatic contrast to the surrounding sandstone woodland. Early explorer descriptions of the swamps as moor like plains are realistic as often these areas can be shrouded in fogs as cloud develops and rises rapidly over the escarpment at Bulli. Since then, both the geomorphology (Young, 1986) and vegetation (Davis, 1941a; Keith & Myerscough, 1993; Keith, 1994) have been well studied.

Young (1986) described these areas as "dells." These form on quaternary sand deposits and humic matter (Hazelton *et al.*, 1990). Keith & Myerscough (1993) described five vegetation communities that grow within these upland swamps. These communities reflected a moisture and nutrient gradient in the underlying soil. Gradation between these different communities is often very rapid, and difficult to distinguish using air photo patterns. Tea-tree Thickets (Map Unit 43), comprised of species such as *Leptospermum juniperinum, Melaleuca squarrosa, Gahnia sieberiana* and *Gleichenia* spp. occur on drainage lines where underlying soils are waterlogged. An impenetrable cover of Banksia Thickets (Map Unit 42) develop on the edge of larger swamps, soaks and minor drainage lines and may also encroach into surrounding sandstone woodland. *Banksia ericifolia* subsp. *ericifolia* and *Hakea teretifolia* are the dominant species of this assemblage. Three other communities, Cyperoid Heath, Restioid Heath and Sedgeland, have been described by Keith (1994) but are mapped as one unit (Sedgeland-Heath Complex - Map Unit 44). Sedges from the Cyperaceae family, including *Gymnoschoenus sphaerocephalus* and *Lepidosperma limicola*, dominate Cyperoid Heath. Low shrubs of *Banksia robur* and *Leptospermum juniperinum* occur patchily. Cyperoid Heath prefers the wetter locations on organic sandy soils within the upland swamp complex, though it is replaced by Tea-tree Thicket in drainage lines. Restioid Heath occupies relatively drier sites within the swamp complex, with sedges from the Restionaceae family forming the dominant ground cover. Species include *Leptocarpus tenax, Empodisma minus* and *Lepyrodia scariosa*. A low spreading shrub layer of *Banksia oblongifolia* and *Hakea teretifolia* is common. Sedgeland occurs on the perimeter of larger upland swamps or on gently sloping 'hanging swamps' in the headwaters of sandstone gully lines. A thick, low cover of sedge species spreads across the extent of the community. Species such as *Leptocarpus tenax, Schoenus brevifolius, Schoenus paludosum* and *Lepyrodia scariosa* are frequently recorded. A number of sparsely scattered low shrubs such as *Sprengelia incarnata, Epacris obtusifolia* and *Symphionema paludosum* are also found.

These patterns are broadly reflected in the available site data in the catchments. However, sites carried out across 400 square metre quadrats tend to mask some of the micro-scale trends that are apparent in the data collected by Keith (1994) using 25 square metre sample areas.

Two additional vegetation communities (Map Units 45 and 46) have been described by this project. The former describes a transitional area between the upland swamp vegetation and the sandstone woodlands, and is called Fringing Eucalypt Woodland. Essentially this fringing swamp community shares species from both the Restioid Heath Complex and the Sandstone Woodlands with a sparse cover of Eucalypts, usually those from the Scribbly Gum complex, *Eucalyptus racemosa/haemastoma*. Mallee-Heath (Map Unit 46) has been taken from work completed by Benson & Fallding (1985) in the southern Avon Catchment. There is no formal site data located in this community, although the descriptions suggested by these authors indicate that the inclusion of the mallee *Eucalyptus stricta* is likely to be a variation to the drier areas within upland swamps commonly occupied by Banksia Thickets.

Two communities aligned to Upland Swamps are located on Mittagong Formation Sandstone in the far south west of the Study Area. Highlands Sandstone *Allocasuarina* Heath (Map Unit 41) features a high abundance of *Allocasuarina paludosa* and *A. diminuta* subsp. *mimica* in combination with *Banksia spinulosa* var. *spinulosa* and *B. oblongifolia.* Highlands Sandstone Swamp Woodland (Map Unit 47) appears to have combinations of species that are found on both sandstone and shale environments. *Eucalyptus ovata, E. radiata* subsp. *radiata, E. mannifera* subsp. *mannifera* and *E. sclerophylla* dominate the open woodland that follows drainage lines and soaks. *Leptospermum juniperinum* and *Banksia spinulosa* var. *spinulosa* form an occasional shrub layer above a damp ground that is covered by *Lomandra longifolia* and *Pteridium esculentum* with rushes such as *Juncus continuus* and *Eleocharis sphacelata.*

4.1.9 Escarpment Cliffs

The escarpment cliffs and upper escarpment slopes provide habitat for a complex of scrubs, heaths and mallees. Directly on and 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 *Tristania collina.* The escarpment cliff complex has been mapped as one unit, Cliffline Coachwood Scrub (Map Unit 5), 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* is 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 (Map Unit 36), as it has been described in this report, covers just over twelve hectares of the Study Area.

4.1.10 Cumberland Plain Woodlands

On the western fringe of the Nepean and Cataract Catchments between Bargo and Appin isolated remnants of the once extensive Cumberland Plain Woodlands remain. Woodlands comprised of *Eucalyptus tereticornis, E. moluccana* and *E. crebra* occur above a sparse shrub cover and very grassy understorey. These vegetation communities (Map Units 20 and 21) are known as Shale Plains and Shale Hills Woodlands (NPWS, 2000d) and were extensively distributed across the Cumberland Plain on Wianamatta Shales at elevations lower than 150 metres. The extent of depletion, the on-going threat of clearing and poor reservation status led these communities to be listed as an Endangered Ecological Community under the Threatened Species Conservation Act, 1995.

4.2 REGIONAL STATUS OF VEGETATION COMMUNITIES

Table 11 describes the regional distribution of each of the communities and provides an estimate of their area in the Sydney Basin Bioregion. The proportion of each of these communities located in formal reserves (NPWS Estate) is also given.

TABLE 11: DISTRIBUTION OF VEGETATION COMMUNITIES OF THE STUDY AREA IN THE SYDNEY BASIN BIOREGION

Map Unit	Vegetation Community	Distribution in Sydney Basin Bioregion	Known Extant Area in Bioregion (ha)	Extant Area in Catchment (ha)	Extant Area and Proportion in NPWS Estate (ha/%)
1	Illawarra Escarpment Subtropical Rainforest	Limited to mid to upper escarpment slopes, gullies and benches between Royal NP and Shoalhaven River. Small areas within Upper Cordeaux Catchment.	8113.5	6.5	2415 (29)
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.	>5000	1380.4	>734(14)
3	Robertson Cool-Warm Temperate Rainforest	Northern limit at Macquarie Hill. Limited remnants found across the Basalt geologies of the Robertson Plateau. Closely related community found on basalt caps in Wollemi and Blue Mountains National Parks. Depauperate examples on Basalt at Mt. Wanganderry, Warragamba Catchment.	571	44.5	5.59 (1.0)

Map Unit	Vegetation Community	Distribution in Sydney Basin Bioregion	Known Extant Area in Bioregion (ha)	Extant Area in Catchment (ha)	Extant Area and Proportion in NPWS Estate (ha/%)
4	Sandstone Riparian Scrub	Widely distributed along narrow sandstone gullies and gorges of the Bioregion. Not well mapped because the community often forms only a narrow riparian ribbon.	>1500	531	975 (65)
5	Cliffline Coachwood Scrub	Extends along the length of the Illawarra Escarpment between Stanwell Park and the Shoalhaven River. Not well mapped because the community is very narrow and located only on cliff edges.	>125	2	7(5)
6	Moist Blue Gum-Blackbutt Forest	Found on Narrabeen gullies of the eastern catchments. Shares some similarity with moist forests found along Hacking River in Royal National Park.	>1200	832.7	41.3 (3.9)
7	Moist Coastal White Box Forest	Majority of distribution occurs on escarpment slopes south of Mt. Kembla to the Shoalhaven River. Small areas in catchments located near escarpment edge.	>3000	6.7	171 (5.7)
8	Moist Gully Gum Forest	South from Mt. Keira to Kiama LGA and extends across Narrabeen gullies of the southern catchments.	>2736	1202.29	1263 (46)
9	Nepean Gorge Moist Forest	Found in deep sandstone gorges of the Nepean Catchment. Closely related to Moist Blue Gum Forests found in similar habitats in the Warragamba Special Area.	3000	417.8	1500 (50)
10	Robertson Basalt Brown Barrel Forest	Remnants of this community are found across the Robertson Plateau and Southern Highlands on Basalt soil.	935	505.5	0 (0)
11	Moist Shale Messmate Forest	Extensively distributed on higher elevations along the broader south coast region escarpment and ranges. In the Study Area it is restricted to eastern Robertson Plateau.	8769	726.8	983 (11)
12	Highlands Ribbon Gum Gully Forest	Likely to be extensively distributed across deeper gullies on shales and basalt soils of the Southern Highlands. Poorly mapped outside of catchments.	>527	527.2	0 (0)
13	Tall Open Gully Gum Forest	Poorly known outside of the catchments.	1150	1150	2.24 (0.2)
14	Tall Open Peppermint-Blue Gum Forest	Poorly known outside of the catchments.	1549	1549	0.51 (0.0)

Map Unit	Vegetation Community	Distribution in Sydney Basin Bioregion	Known Extant Area in Bioregion (ha)	Extant Area in Catchment (ha)	Extant Area and Proportion in NPWS Estate (ha/%)
15	Tall Open Blackbutt Forest	South from Royal National Park. Further investigation is required into relationships with Blackbutt Forests of the South Coast Hinterland.	2410	968	1422 (59)
16	Tall Blackbutt-Apple Shale Forest	Localised community occurring between Bulli Tops and Royal National Park. Not described elsewhere.	379	24	343 (90.5)
17	O'Hares Creek Shale Forest	Not described elsewhere in the Bioregion.	285	285	23.39 (8.2)
18	Highlands Shale Tall Open Forest	Found across Southern Highlands particularly near interface with Sandstone Plateaux near Bundanoon and Alpine.	8769	3435	0 (0)
19	Transitional Shale Open Blue Gum Forest	Forms part of the Shale Sandstone Transition Forest (Low Sandstone Influence) Complex on the margins of the Cumberland Plain.	3324	36	16.6 (0.5)
20	Cumberland Shale Hills Woodland	Heavily depleted community found on the hills and rises of the southern Cumberland Plain, Western Sydney.	4309	41	185.3 (4.3)
21	Cumberland Shale Plains Woodland	Heavily depleted community found on the Cumberland Plain, Western Sydney.	6745	112	566.6 (8.4)
22	Transitional Shale Dry Ironbark Forest	Forms part of the Shale Sandstone Transition Forest (Low and High Sandstone Influences, NPWS 2000a) Complex on the margins of the Cumberland Plain.	2766	1533	0 (0)
23	Transitional Shale Stringybark Forest	Forms part of the Shale Sandstone Transition Forest (High Sandstone Influence) Complex on the margins of the Cumberland Plain.	8706	615	217.7 (2.5)
24	Highlands Alluvial Red Gum Woodland	Found on Alluvial soils across the Southern Highlands north from Goulburn to Mittagong.	2140	93	0 (0)
25	Sandstone Gully Apple-Peppermint Forest	South from Georges River to Bulli Tops on the Woronora Plateau.	11868	3963	9732 (82)
26	Sandstone Gully Peppermint Forest	South from Bulli Tops to Morton NP.	24500	9995	8996 (38)
27	Nepean Sandstone Gully Forest	West from Nepean Catchment to Nattai National Park, Buxton and Wild Goat Plateau in the Warragamba Catchment	>15000	7321	>8000 (53)
28	Western Sandstone Gully Forest	North from Broughton Pass, Cataract Catchment to Holsworthy Military Area and Georges River.	7873	621	535.4 (6.8)

Map Unit	Vegetation Community	Distribution in Sydney Basin Bioregion	Known Extant Area in Bioregion (ha)	Extant Area in Catchment (ha)	Extant Area and Proportion in NPWS Estate (ha/%)
29	Exposed Sandstone Scribbly Gum Woodland	Extensive across the Woronora Plateau, south from Royal NP.	36172	35964	3241.28 (9.0)
30	Nepean Enriched Sandstone Woodland	Restricted to Mittagong Formation Sandstone Geology in the Nepean Catchment. May also be found in the Thirlmere-Buxton area.	>5503	5503	0 (0)
31	Highlands Sandstone Scribbly Gum Woodland	Higher elevation sandstone woodlands found south of Nepean Catchment and across Morton and Bundanoon Plateaux.	48899	951	15403 (31.5)
32	Escarpment Edge Silvertop Ash Forest	Along the escarpment edge south from Royal NP to Morton NP.	14953	488	8966 (60)
33	Silvertop Ash Ironstone Woodland	Localised community found between Royal National Park and O'Hares Catchment.	1453	602	991 (68)
34	Sandstone Heath-Woodland	Localised community found between Royal National Park and O'Hares Catchment.	>500	409	>220 (44)
35	Upper Georges River Sandstone Woodland	North from Bargo to Holsworthy Military Area.	7102	1950	113.6 (1.6)
36	Budawang Ash Mallee Scrub	South from Wombarra to Kiama LGA.	>15	12.17	5 (33.3)
37	Dwarf Apple Heath	Widespread across Sydney Basin Bioregion although generally small and patchy distribution. South from Wollemi and Yengo National Parks to O'Hares Creek.	>500	12	>250 (50)
38	Rock Pavement Heath	Poorly mapped and described community. Likely to be widespread across Sandstone environments of the Bioregion, although few are likely to include *Callitris* spp. as found in the Catchments.	>80	79	>11 (5.3)
39	Rock Plate Heath-Mallee	Widespread though restricted to small areas of suitable habitat between Morton and Wollemi NPs.	>1500	822	>700 (46.7)
40	Woronora Tall Mallee-Heath	North from O'Hares Creek to Brisbane Waters NP.	>547	547	>28.5 (5.2)
41	Highlands Sandstone Allocasuarina Heath	Poorly described elsewhere.	>59	59	0 (0)

Map Unit	Vegetation Community	Distribution in Sydney Basin Bioregion	Known Extant Area in Bioregion (ha)	Extant Area in Catchment (ha)	Extant Area and Proportion in NPWS Estate (ha/%)
42	Upland Swamps: Banksia Thicket	Widespread across Sandstone Plateaux of the Bioregion although most extensive on the Morton and Woronora Plateaux. Generally describes as Sandstone Wet Heath Complexes. Between Wollemi and Morton NPs.	>47000*	1120	>41830 (89)*
43	Upland Swamps: Tea-tree Thicket	Widespread across Sandstone Plateaux of the Bioregion although most extensive on the Morton and Woronora Plateaux. Generally describes as Sandstone Wet Heath Complexes. Between Wollemi and Morton NPs.	>47000*	170	>41830 (89)*
44	Upland Swamps: Sedgeland-Heath Complex	Widespread across Sandstone Plateaux of the Bioregion although most extensive on the Morton and Woronora Plateaux. Generally describes as Sandstone Wet Heath Complexes. Between Wollemi and Morton NPs.	>47000*	3448	>41830 (89)*
45	Upland Swamps: Fringing Eucalypt Woodland	Widespread across Sandstone Plateaux of the Bioregion although most extensive on the Morton and Woronora Plateaux. Generally describes as Sandstone Wet Heath Complexes. Between Wollemi and Morton NPs.	>47000*	1579.95	>41830 (89)*
46	Upland Swamps: Mallee-Heath	Widespread across Sandstone Plateaux of the Bioregion although most extensive on the Morton and Woronora Plateaux. Generally describes as Sandstone Wet Heath Complexes. Between Wollemi and Morton NPs.Found near escarpment edge near Ohares and Avon Catchments	>47000*	124	>41830 (89)*
47	Highlands Sandstone Swamp Woodland	Poorly described but likely to be aligned with other Sandstone Wet Heath Communities.	>439.60	440	0 (0)
48	Highlands Swamp Gum-*Melaleuca* Woodland	South and west from Macquarie Hill, poorly described elsewhere on the Southern Highlands.	>144	144	0.21 (0.1)

* Figures for Upland Swamps combined.

4.2.1 Rainforests

The most extensive type of rainforest is Map Unit 2 - Coachwood Warm Temperate Rainforest. Along with Sandstone Riparian Scrubs it has the most area conserved of the rainforest types in the Bioregion. Map Unit 1 - Illawarra Escarpment Subtropical Rainforest and Map Unit 3 - Robertson Cool-Warm Temperate Rainforest are less well conserved, with the latter heavily depleted from the original distribution on the Basalt soils of the Robertson Plateau. Consequently it has been listed as an Endangered Ecological Community. Recent mapping for the Wingecarribee Shire Council (Eco Logical Australia, 2002) suggests that around seventeen percent of its original distribution remains.

4.2.2 Moist Forests

The Moist Forest vegetation is a feature of protected slopes and gullies of Narrabeen geologies on the eastern side of the catchments. Map Units 7 and 8 are found along the southern Illawarra Escarpment as well as within the catchments, albeit in smaller areas. Map Unit 6 - Moist Blue Gum-Blackbutt Forest has more in common with gully line vegetation along the Hacking River in Royal National Park. These communities have a relatively high proportion of their extant distribution located within reserves. A number of Moist Forests located on shale or basalt soils of the southern highlands are listed on the Threatened Species Conservation Act as Endangered Ecological Communities. Map Units 10, 11 and 12 are all part of either the Robertson Tall Open- forest or the Southern Highlands Shale Woodlands determinations. Nepean Gorge Moist Forest is restricted to the deepest and narrowest gorges in the Nepean Catchment. The moist component is characterised by a depauperate Coachwood Warm Temperate mesic shrub layer that has greater affinities to similar habitats on the Nattai Plateau in the Warragamba Special Area.

4.2.3 Tall Open Forests

Tall Open Forests are characteristic of exposed locations on richer soils. Soil type may vary from Wianamatta Shale, Narrabeen Shales and Sandstones to Hawkesbury Sandstone with Shale lenses. O'Hares Creek Shale Forest (Map Unit 17) is listed as an Endangered Ecological Community. The area within the catchments represents the total area known in the Bioregion. Another Endangered Ecological Community, Map Unit 18 (Highlands Shale Tall Open Forest) is characterised by a canopy species not listed on the determination, although the total floristic composition is closely matched. The areas within the catchments represent the most extensive samples of this community in the Bioregion. Transitional Shale Open Blue Gum Forest (Map Unit 19) occurs on a single isolated patch of residual shale in western Cataract Catchment. The floristics of this site is most closely aligned to Transitional Shale Sandstone Forests (Low Sandstone Influence) that are found on the rim of the shales of the Cumberland Plain (NPWS, 2000d). Map Units 15 and 16 share a similar forest structure. However, the latter, Tall Open Blackbutt-Apple Shale Forest, occurs on isolated caps of shale in the far north east of the catchment, the biggest of which now lies underneath the township of Helensburgh. Only a small portion of this community occurs in Woronora Catchment, with remaining areas found in Royal and Heathcote National Parks. Tall Open Blackbutt Forest (Map Unit 16) shares greater similarities with components of both the tall forests of the Hacking River side slopes and to a lesser degree the Escarpment Blackbutt along the northern Illawarra escarpment. Other tall open forests, Map Units 13 and 14 are not described elsewhere in the literature and may be restricted to areas within the catchments.

4.2.4 Shale Woodlands

All vegetation communities comprising this group, except Map Unit 24, are listed as Endangered Ecological Communities, forming part of the Cumberland Plain Woodlands and Transitional Shale Sandstone Forests determinations. These communities are all typified by high levels of depletion, poor reservation status and on-going threatening processes. Map Unit 24 (Highlands Alluvial Red Gum Woodland) remains unsampled, although his highly likely to also be a component of the Southern Highlands Shale Woodlands determination.

4.2.5 Sandstone Forests and Woodlands

Variation in sandstone forests and woodlands arises from changes in soil, elevation and rainfall. Two exposed sandstone communities occur more prominently in sandstone environments south of the Study Area. Escarpment Edge Silvertop Ash Forest (Map Unit 32) is closely related to Forest Ecosystem 137: Coastal Escarpment Moist Shrub/Fern Forest (NPWS, 2000a), a forest ecosystem described for the Southern CRA Region. It is a feature of the eastern Morton plateau, Budawang National Park and between Fitzroy Falls and Budderoo National Park. The Study Area represents the northern limit of this community.

Highlands Sandstone Scribbly Gum Woodland (Map Unit 31) occurs in high elevations in the Nepean Catchment. It is closely related to Forest Ecosystem 139: Northern Coastal Hinterland Heath Shrub Dry Forest (NPWS, 2000a). This ecosystem is also distributed throughout Budderoo and Morton National Parks. As a result the reservation levels for these communities are relatively high.

Exposed Sandstone Scribbly Gum Woodland (Map Unit 29) is the most widespread community in the Catchment. The floristics of this community differs from those exposed sandstone communities found in Warragamba Special Area, Royal National Park and Holsworthy. Further analyses are required to examine other sandstone woodlands found in Ku-ring-gai Chase, Marramarra, Wollemi, Yengo and Brisbane Waters National Parks.

Nepean Enriched Sandstone Woodland (Map Unit 30) and Upper Georges River Sandstone Woodland (Map Unit 35) both occur predominantly on Mittagong Formation Sandstones, a slightly richer soil than those derived from the Hawkesbury series. Map Unit 35 is more extensively distributed between Appin and Holsworthy with the area in Cataract Catchment representing a small portion of the total area of the community.

Sandstone Gully vegetation is also well protected in the current reserve system. Sandstone Gully Apple-Peppermint Forest (Map Unit 25) occurs across O'Hares and Woronora Catchments and extends throughout Royal National Park. The closely related Sandstone Gully Peppermint Forest (Map Unit 26) is not located within formal reserves but is widespread through Cordeaux, Cataract and Avon catchments. Nepean Sandstone Gully Forest (Map Unit 27) occurs at higher elevations in drier areas across the Nepean Catchment. A close association with sandstone gullies was achieved with similar habitats in the Nattai and Burragorang plateaux in the Warragamba Special Area.

Western Gully Sandstone Forest is less protected in formal reserves as it features along the interface of the Campbelltown urban area and within Holsworthy Military Area. O'Hares Catchment supports the largest protected area.

Two Sandstone Woodland Communities appear to be influenced by a mantle of lateritic material (ironstone) within the O'Hares and Woronora Catchments. Silvertop Ash Ironstone Woodland is concentrated in the eastern half of the O'Hares Catchment, with less frequent occurrences in Woronora Catchment and Royal National Park. These lateritic soils are often associated with shale lenses within the sandstones of the Hawkesbury Series. They are generally small and patchily distributed with occurrences previously noted in Brisbane Waters and Ku-ring-gai Chase National Parks, Somersby Plateau and the Duffys Forest area. The Duffys Forest Vegetation Community has been listed as an Endangered Ecological Community under the TSC Act, 1995. Smith & Smith (2000) have carried out some investigations into the composition and regional variations in these lateritic communities. They concluded that the Silvertop Ash Ironstone Woodland found in the O'Hares Creek Catchment is unlikely to be related to Duffys Forest. Lateritic soils found on the Somersby Plateau are more likely to share floristic similarity (pers. obs.), particularly as the conspicuous *Doryanthes excelsa* and *Eucalyptus sieberi* dominate. Such conclusions have not been explicitly tested and remain a future endeavour.

Sandstone Heath-Woodland is also characterised by a thin and fragmented cover of laterite on broad flat ridges. Keith (1994) suggests that more extensive areas occur in the Menai-Holsworthy Area, though more recent studies in these areas (French *et al.*, 2000; NPWS, 2000c) were unable to distinguish this assemblage on floristic composition at the scale at which they were mapped. Other potential localities within the Bioregion include Royal National Park and the Hornsby Plateau as noted by Keith (1994).

4.2.6 Mallees, Heaths and Scrubs

The broad group of communities that define the Mallees, Heaths and Scrubs have naturally restricted distributions, with all of them occurring on sandstone substrates. Budawang Ash Mallee Scrub (Map Unit 36) is highly restricted to the escarpment edge between Coalcliff in the north and at least as far south as Kiama. While the species *Eucalyptus dendromorpha* is known from the Blue Mountains, the assemblage defined here is thinly distributed.

Dwarf Apple Heath (Map Unit 37) described by Keith (1994) occupies a single site within O'Hares Creek Catchment. The indicator species *Angophora hispida* in this heath complex, is more widely distributed in Holsworthy Military Area (French *et al.*, 2000) and may occur sporadically along the western fringe of the Woronora Catchment. Dwarf Apple heathlands are found in Dharug, Ku-ring-gai Chase, Yengo and Garigal National Parks and share some species but differ in their complete assemblage.

Rock Plate Heath Mallee (Map Unit 39) occurs throughout the catchments and into Royal National Park. Closely related Mallee-Heaths are present throughout the sandstone environments of the Bioregion, although minor floristic variation occurs. Nattai and Blue Mountains National Parks support good examples of this assemblage.

Woronora Tall Mallee Heath (Map Unit 40) features *Eucalyptus luehmanniana,* a species narrowly confined to the Sydney Bioregion in highly localised patches between O'Hares Creek Catchment and the Central Coast. The Woronora Catchment supports some of the more extensive patches of this community. It is present in Heathcote (pers. obs.), Royal, Garigal and Ku-ring-gai Chase National Parks (Keith, 1994).

Rock Pavement Heath (Map Unit 38) is often overlooked in mapping projects because it is small and highly localised community, and often difficult to identify using remote sensing mapping techniques. The total area of this assemblage within the Bioregion is highly underestimated, and it can be assumed that is more extensive throughout sandstone environments. Keith (1994) notes that minor floristic differences may arise between areas, although sites in Royal, Heathcote and Nattai National Parks are likely to be analogous.

Highlands Sandstone *Allocasuarina* Heath is an unusual community within the Bioregion. Its distribution is poorly understood, though Benson & Howell (1994) indicate that a similar assemblage is present at Heathcote. Like other heath communities the total area within the Bioregion is likely to be small with most occupying sites in the extensive sandstone reserve system.

4.2.7 Upland Swamps

Upland Swamps are a feature of sandstone plateaux across the Bioregion, although nowhere are they as extensive as those found in the Study Area. The Maddens Plains area is the centre point of these vegetation communities within the catchments. Keith (1994) notes that sedgeland (a component of Map Unit 44) has a very limited and patchy distribution. This is supported by observations during this study. Outside of the Study Area, examples of this vegetation type are found in Holsworthy and Royal National Park (Keith, 1994), and may be present elsewhere.

Cyperoid Heath is analogous to Forest Ecosystem 141: North Coast (and Escarpment) Wet Heath Sedge for the Southern CRA Region, although *Banksia robur* is not part of the assemblage in these southern locations. However, a substantial proportion of its original distribution remains in reserves. A similar assemblage is present in the Warragamba Special Area, and in Blue Mountains, Ku-ring-gai Chase and Brisbane Waters National Parks.

Tea-tree Thickets (Map Unit 43) are poorly mapped within the Bioregion as they are small and restricted features. Keith (1994) indicates that Royal and Ku-ring-gai Chase National Parks support examples of this community, as do limited areas within the Warragamba Special Area and Blue Mountains National Park.

Restioid Heath (a component of Map Unit 44) is extensive throughout the Study Area, although its distribution in the Bioregion is less well known. Keith (1994) found similarities with vegetation present amongst the Ku-ring-gai Chase and Brisbane Waters National Parks Upland Swamp complexes. A loosely related assemblage is described by Ecosystem 144: Northern Coast and Hinterland Moist Heath (NPWS, 2000a) for areas within Morton National Park.

Banksia Thickets (Map Unit 42) feature throughout the catchment developing a dense perimeter to the sedgeland and heath complexes. Keith (1994) notes that Banksia Thickets are present amongst similar upland swamps already described although some differences arise with the presence or absence of *Allocasuarina distyla.* Ecosystem 140 Northern Coastal Wet Heath (NPWS, 2000a) shares a similar composition of species in the south coast region.

As much of the preferred habitat for upland swamps exists in areas that have not experienced heavy urban development and agricultural pressures, large areas remain in protected areas.

Two further communities (Map Unit 47 and 48) are not well sampled in this survey and are poorly described elsewhere. Remaining stands of Swamp Gum-*Melaleuca* Woodland occurs on shale derived soils and is likely to be poorly reserved.

4.3 ENDANGERED ECOLOGICAL COMMUNITIES

The NSW Scientific Committee have listed a number of vegetation assemblages that occur within the Study Area as Endangered Ecological Communities under the Threatened Species Conservation Act, 1995. These communities are:

- Robertson Basalt Tall Open-forest
- Southern Highlands Shale Woodlands
- O'Hares Creek Shale Forest
- Cumberland Plain Woodland
- Shale/Sandstone Transition Forest
- Robertson Rainforest

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. All of the determinations make clear that the listing applies to the Sydney Basin Bioregion only.

TABLE 12: RELATIONSHIP BETWEEN ENDANGERED ECOLOGICAL COMMUNITIES (TSC ACT, 1995) AND VEGETATION COMMUNITIES DESCRIBED IN THIS REPORT

Endangered Ecological Community Name	Corresponding Vegetation Community (this report)
O'Hares Creek Shale Forest	O'Hares Creek Shale Forest
Cumberland Plain Woodland	Cumberland Shale Plains Woodland Cumberland Shale Hills Woodland
Shale/Sandstone Transition Forest	Transitional Shale Dry Ironbark Forest Transitional Shale Stringybark Forest Transitional Shale Open Blue Gum Forest
Southern Highlands Shale Woodlands	Highlands Alluvial Red Gum Woodland Highlands Ribbon Gum Gully Forest Highlands Shale Tall Open Forest
Robertson Basalt Tall Open-forest	Robertson Basalt Brown Barrel Forest Moist Shale Messmate Forest
Robertson Rainforest	Robertson Cool-Warm Temperate Rainforest

Table 12 indicates the relationship between the determinations and the classification used in this report. Several of these determinations describe broad vegetation communities that have been divided into their component parts in this report. The distributions of these communities are shown in Map 13.

4.4 DISTURBANCE ASSESSMENT

Users of data relating to the disturbance assessment need to be cautious with how this information is applied. The mapping process highlights patterns and indicators of disturbance that may affect the condition of vegetation. The impact of any disturbance event on the species diversity at any given site needs to be examined using field based methods. It is inappropriate that the disturbance assessment be used to disregard the contribution of particular patches of vegetation to a conservation goal that seeks to maximise biodiversity. Vegetation that presents evidence of high levels of disturbance may still support significant numbers of native species. As a result disturbance data is best applied to issues that draw attention to management issues such as threatening processes (weeds, clearing etc).

However the assessment of disturbance features has been completed in order to develop a relative index of disturbance intensity 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.

Such data provides an indication of the degree of threatening processes impacting on a particular vegetation community across their entire distribution 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.

Table 13 lists the proportions of each vegetation community that have low, medium and high levels of disturbance, as recorded during API. The latter category includes Scattered Trees that is essentially remnant trees over a completely degraded understorey. The table is sorted in order of most disturbed to least.

The areas with the most fertile soils, particularly those derived from volcanic substrates, have been the most effected by disturbance. Coupled with the fact that these areas have suffered the greatest rates of clearing, the vegetation communities present occupy a far smaller area than their original extent. The three areas that have suffered the highest disturbance are:

- Robertson Plateau – High levels of clearance, with many remnants consisting of regenerating Acacia Scrubs, consisting of weeds or planted exotics or subject to high levels of disturbance.
- Upper Cordeaux – The rainforests and moist forests have been cleared in the past and now are regenerating as Acacia Scrubs, or exhibit high levels of disturbance.
- Cataract Catchment – Allen Creek in the north has been previously cleared, and much of the vegetation shows high levels of disturbance, whilst further south around Bellambi and Cataract Creeks, large areas of Turpentine Regeneration occur, particularly east of the Princes Highway.

The areas of shale along the western boundary of the Study Area and at isolated patches, such as at Darkes Forest, have also generally been cleared in the past, and remain in agricultural usage today. In comparison, the vegetation communities present in the northern, less fertile catchments of O'Hares Creek and Woronora River, have suffered far less disturbance, with the main disturbance being associated with powerline easements and tracks established as fire trails and associated with the mining infrastructure.

TABLE 13: VEGETATION COMMUNITY BY DISTURBANCE INTENSITY (PERCENTAGE OF EXTANT VEGETATION)

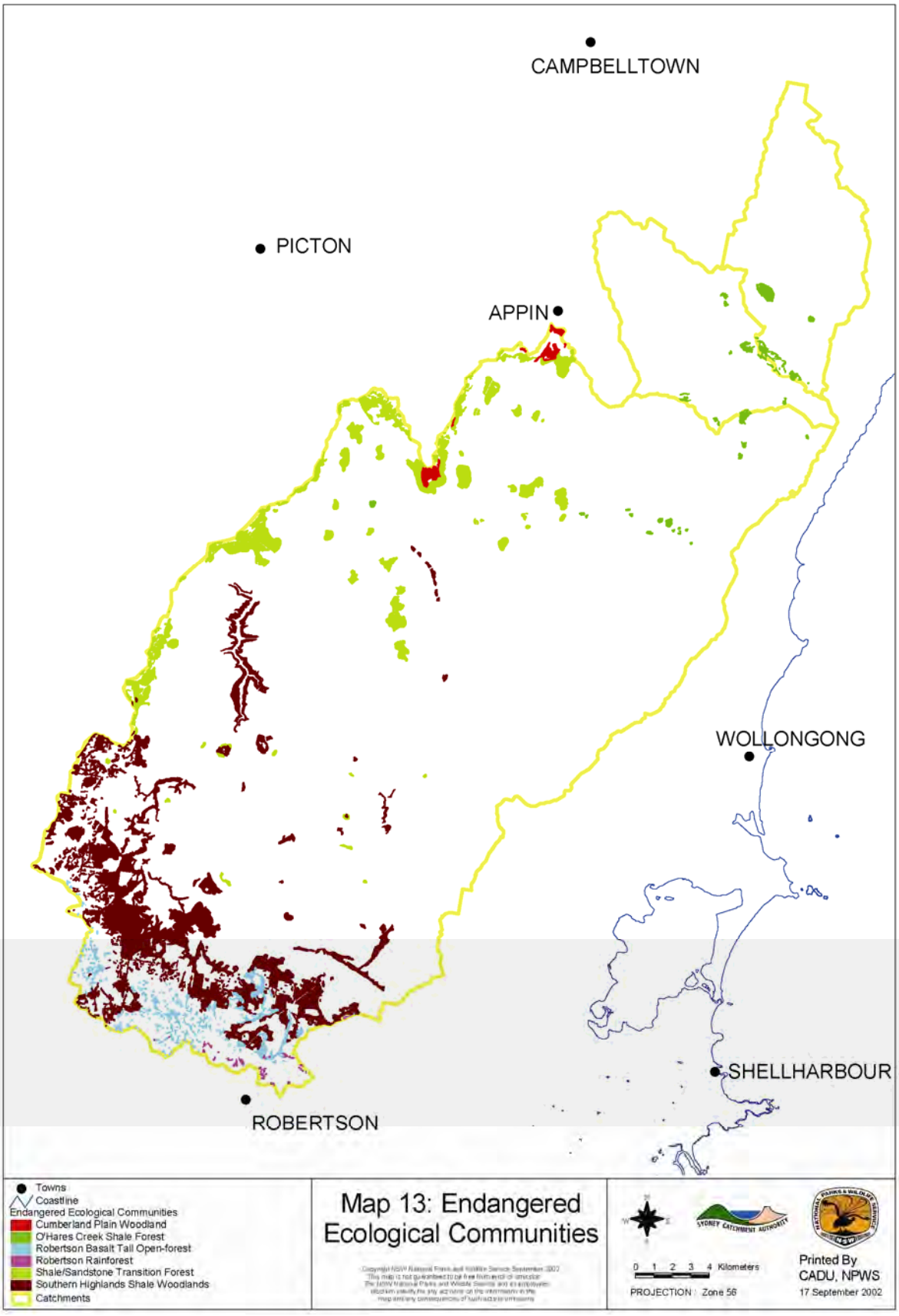
Map Unit	Vegetation Community Name	Low Disturbance (%)	Moderate Disturbance (%)	High Disturbance (%)*
MU3	Robertson Cool-Warm Temperate Rainforest	20.5	5.5	74.0
MU1	Illawarra Escarpment Subtropical Rainforest	19.8	7.0	73.2
MU24	Highlands Alluvial Red Gum Woodland	11.1	22.7	66.1
MU10	Robertson Basalt Brown Barrel Forest	35.6	6.0	58.5
MU20	Cumberland Shale Hills Woodland	46.2	0	53.8
MU21	Cumberland Shale Plains Woodland	2.3	63.6	34.1
MU7	Moist Coastal White Box Forest	60.1	14.8	25.1
MU18	Highlands Shale Tall Open Forest	77.0	6.2	16.8
MU22	Transitional Shale Dry Ironbark Forest	70.9	13.0	16.1
MU11	Moist Shale Messmate Forest	81.1	4.7	14.1
MU6	Moist Blue Gum-Blackbutt Forest	45.1	41.4	13.5
MU17	O'Hares Creek Shale Forest	89.0	0	11.0
MU48	Highlands Swamp Gum-*Melaleuca* Woodland	82.8	7.5	9.7
MU14	Tall Open Peppermint-Blue Gum Forest	59.3	31.5	9.2
MU8	Moist Gully Gum Forest	68.3	24.2	7.5
MU12	Highlands Ribbon Gum Gully Forest	92.5	0.8	6.7
MU13	Tall Open Gully Gum Forest	67.1	27.2	5.6
MU15	Tall Open Blackbutt Forest	79.6	15.7	4.6
MU33	Silvertop Ash Ironstone Woodland	93.1	2.7	4.2

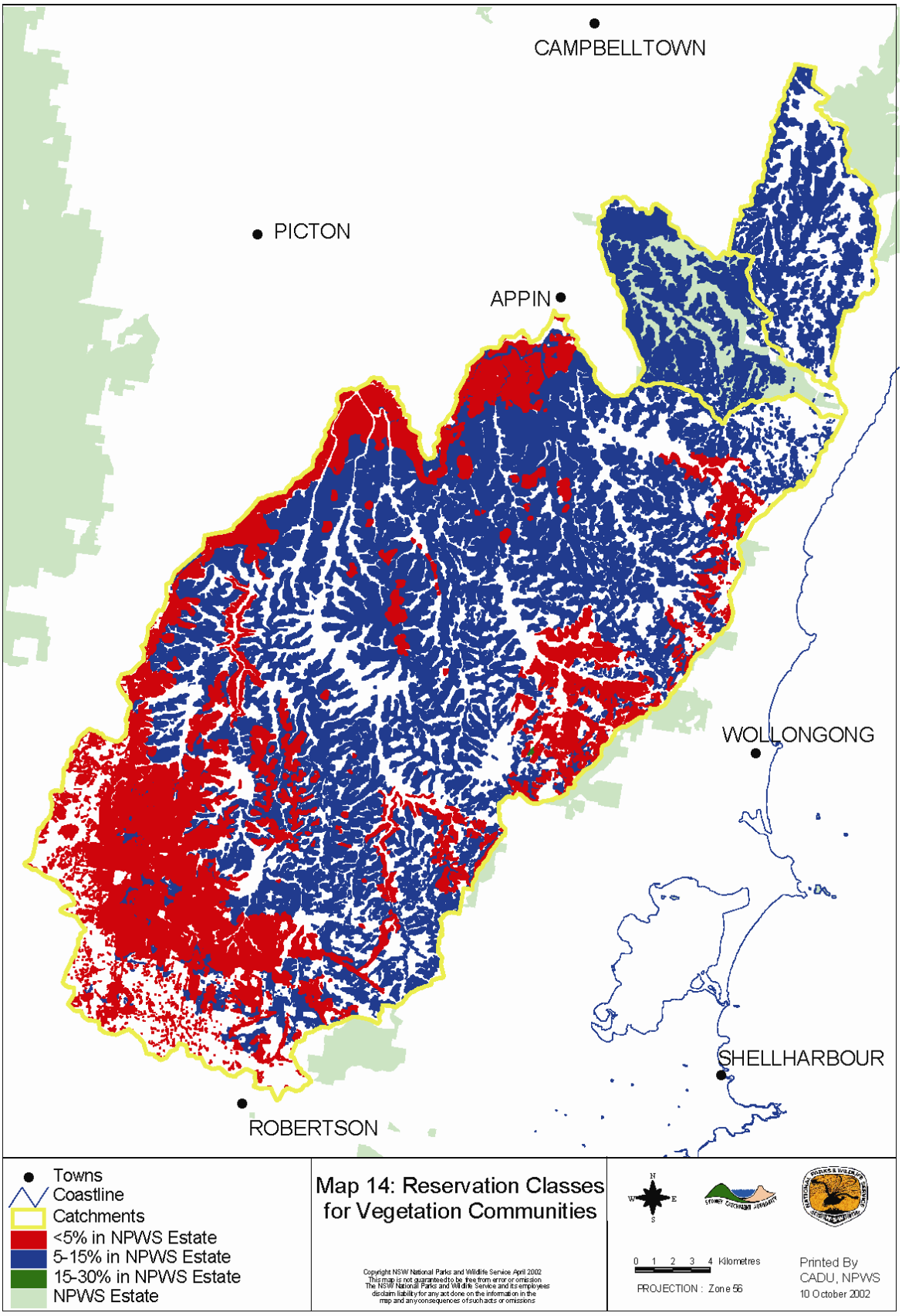
Map Unit	Vegetation Community Name	Low Disturbance (%)	Moderate Disturbance (%)	High Disturbance (%)*
MU2	Coachwood Warm Temperate Rainforest	71.9	24.2	3.8
MU31	Highlands Sandstone Scribbly Gum Woodland	94.1	2.4	3.5
MU16	Tall Blackbutt-Apple Shale Forest	29.0	68.1	2.9
MU35	Upper Georges River Sandstone Woodland	92.6	6.2	1.2
MU32	Escarpment Edge Silvertop Ash Forest	98.7	0.4	0.9
MU25	Sandstone Gully Apple-Peppermint Forest	99.3	0.2	0.5
MU29	Exposed Sandstone Scribbly Gum Woodland	99.1	0.5	0.4
MU27	Nepean Sandstone Gully Forest	99.7	0.2	0.1
MU4	Sandstone Riparian Scrub	99.9	0	0.1
MU30	Nepean Enriched Sandstone Woodland	99.9	0	0.1
MU23	Transitional Shale Stringybark Forest	98.3	1.7	0
MU28	Western Sandstone Gully Forest	98.7	1.3	0
MU42	Upland Swamps: Banksia Thicket	99.8	0.2	0
MU26	Sandstone Gully Peppermint Forest	100	0	0
MU5	Cliffline Coachwood Scrub	100	0	0
MU9	Nepean Gorge Moist Forest	100	0	0
MU19	Transitional Shale Open Blue Gum Forest	100	0	0
MU34	Sandstone Heath-Woodland	100	0	0
MU36	Budawang Ash Mallee Scrub	100	0	0
MU37	Dwarf Apple Heath	100	0	0
MU38	Rock Pavement Heath	100	0	0
MU39	Rock Plate Heath-Mallee	100	0	0
MU40	Woronora Tall Mallee-Heath	100	0	0
MU41	Highlands Sandstone *Allocasuarina* Heath	100	0	0
MU43	Upland Swamps: Tea-tree Thicket	100	0	0
MU44	Upland Swamps: Sedgeland-Heath Complex	100	0	0
MU45	Upland Swamps: Fringing Eucalypt Woodland	100	0	0
MU46	Upland Swamps: Mallee-Heath	100	0	0
MU47	Highlands Sandstone Swamp Woodland	100	0	0

* Includes Scattered Trees

Compared to areas with higher disturbance from agriculture and urbanisation, such as the Illawarra Coastal and Cumberland Plains, weeds form only a relatively small problem with the Study Area. Table 14 lists some of the exotic species recorded at survey sites during the various surveys undertaken in the catchments. This list will not be complete, due to the fact that most sites are undertaken in areas of minimal disturbance. Other species known to be present include Pampas grass (*Cortaderia selloana*) and Willows (*Salix* spp.).

This disturbance assessment does not take into account fires, particularly the January 2002 fires, which may have significant effects on the structure and species composition of a vegetation community.


CAMPBELLTOWN
PICTON
APPIN
WOLLONGONG
SHELLHARBOUR
ROBERTSON
Towns
Coastline
Endangered Ecological Communities
Cumberland Plain Woodland
O'Hares Creek Shale Forest
Robertson Basalt Tall Open-forest
Robertson Rainforest
Shale/Sandstone Transition Forest
Southern Highlands Shale Woodlands
Catchments
Map 13: Endangered Ecological Communities
0 1 2 3 4 Kilometers
PROJECTION : Zone 56
Printed By
CADU, NPWS
17 September 2002


CAMPBELLTOWN
PICTON
APPIN
WOLLONGONG
SHELLHARBOUR
ROBERTSON
Towns
Coastline
Catchments
<5% in NPWS Estate
5-15% in NPWS Estate
15-30% in NPWS Estate
NPWS Estate
Map 14: 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
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CADU, NPWS
10 October 2002

4.5 RESERVATION STATUS ASSESSMENT

The proportion of a Vegetation Community located within formal reserves is regularly used as one indicator of conservation status. More recently, such calculations have been made using the estimated distributions of vegetation communities prior to European arrival in Australia (JANIS, 1997). Other measures that review the conservation status in the JANIS criteria consider the configuration of protected areas across the range of the vegetation community and the degree of fragmentation.

Table 11 lists the reservation status of each community in NPWS Estate within the Sydney Basin Bioregion. Map 14 shows the distribution with the Study Area of the vegetation communities that have less than five, fifteen and thirty percent of their extant distribution within the Bioregion within NPWS reserves. Occurrence in NPWS managed lands does not guarantee that the natural values are free of threatening processes, it does give an indication of whether the community is likely to be effected by additional clearing for agriculture or urban development. It should also be noted, that the communities present within the Schedule 1 Catchment land are afforded similar levels of protection.

TABLE 14: NTRODUCED SPECIES RECORDED AT SURVEY SITES WITHIN THE STUDY AREA, INCLUDING NUMBER OF SITES

Family	Scientific Name	Common Name	No. of Sites
Amygdalaceae	*Prunus laurocerasus*	Cherry Laurel	2
Amygdalaceae	*Prunus lusitanica*	Portugal Laurel	1
Aquifoliaceae	*Ilex aquifolium*	Holly	6
Asparagaceae	*Protasparagus aethiopicus*	Sprengeri Fern	1
Asteraceae	*Ageratina adenophora*	Crofton Weed	7
Asteraceae	*Bidens pilosa*	Cobbler's Pegs	1
Asteraceae	*Cirsium vulgare*	Spear Thistle	3
Asteraceae	*Conyza albida*	Tall Fleabane	1
Asteraceae	*Conyza bonariensis*	Flaxleaf Fleabane	1
Asteraceae	*Conyza canadensis* var. *canadensis*	Canadian Fleabane	1
Asteraceae	*Hypochaeris radicata*	Catsear	8
Asteraceae	*Senecio madagascariensis*	Fireweed	3
Caryophyllaceae	*Polycarpon tetraphyllum*	Four-leaved Allseed	1
Convolvulaceae	*Cuscuta campestris*	Golden Dodder	1
Euphorbiaceae	*Phyllanthus tenellus*	Hen and Chicken	2
Juncaceae	*Juncus bufonius*	Toad Rush	1
Oleaceae	*Ligustrum sinense*	Small-leaved Privet	2
Phytolaccaceae	*Phytolacca octandra*	Inkweed	1
Plantaginaceae	*Plantago lanceolata*	Lamb's Tongues	1
Poaceae	*Andropogon virginicus*	Whisky Grass	1
Poaceae	*Poa pratensis*	Kentucky Bluegrass	1
Rosaceae	*Rubus discolor*	Blackberry	2
Rosaceae	*Rubus fruticosus* spp. agg.	Blackberry	4
Rosaceae	*Rubus rosifolius*	Rose-leaf Bramble	2
Rosaceae	*Rubus ulmifolius*	Blackberry	5
Scrophulariaceae	*Kickxia elatine* subsp. *crinita*	Twining Toadflax	1

Family	Scientific Name	Common Name	No. of Sites
Solanaceae	*Solanum mauritianum*	Wild Tobacco Bush	1
Verbenaceae	*Lantana camara*	Lantana	1
Violaceae	*Viola odorata*	Sweet Violet	1

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 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 less accuracy in the diagnostic species lists 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 15 provides an example from which to discuss the interpretation of the diagnostic species list.

TABLE 15: EXAMPLE DIAGNOSTIC SPECIES LIST – MAP UNIT X

Species Name	Median Cover Abundance Score in this Map Unit	Frequency of occurrence in sites describing this Map Unit (%)	Median Cover Abundance Score in other map Units	Frequency of occurrence in sites describing other Map Units	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

Median Cover Abundance Score and Frequency of Occurrence in this Map Unit: These refer to the median cover abundance and frequency at which these species have occurred in the sites that have been used to define this community. Using the table above it can be seen that *Croton verreauxii* has occurred at a median cover abundance of 3 in 82% of sites that describe MU X.

Median Cover Abundance Score and Frequency of Occurrence in other Map Units: These provide a comparative median cover abundance score and frequency of occurrence for this species across all other sites (communities). In this example, *Croton verreauxii* has occurred in 23% of all other at a median cover abundance of 3 for all other sites describing other Map Units.

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 *Cassine australis* var. *australis* occurs at 100% of the sites within this community at a median cover abundance of 4, while it occurred in only 35% 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.

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 *Livistona australis* has not been recorded at all in this community and that it occurs in 52% of sites outside 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% of sites within the community, at a median cover abundance of 2. This does not help to differentiate this community as the species was recorded in 61% of all other sites also with a median 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 insufficient sampling. However, with communities that have been sampled by a larger number of replicates, diagnostic species can be used to identify particular communities from one another, if identical field survey methods are employed. Reliability of identification will increase with the greater number of positive diagnostic species identified at a site. Confidence can also be improved with an understanding of the habitat and structural characteristics of the vegetation community of interest.

4.7 MAP ACCURACY

The derived map of vegetation communities has a number of potential sources of error. The spatial or positional accuracy has already been described. Nevertheless, it is important to reiterate that the distortion arising from the steep gorges may generate spatial discrepancies of up to 50 metres between the vegetation map and orthorectified digital imagery.

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

Some vegetation communities have not been sampled and require further work to clarify the relationships with other communities in the Study Area and to those elsewhere in the region.

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 1:50000 and 1:100000 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 is artificial. Site based assessments are required, particularly when dealing with Endangered Ecological Communities.

4.8 USING THE REPORT AND MAP

This report and the accompanying map provide Catchment Land Managers 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 vegetation community across the Study Area; and
- the reservation status of each community at a local and regional level.

The vegetation map is available as an electronic data layer for use with GIS systems. These data layers support a number of additional features that can be used for site by site assessments. A large dumber 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;
- understand variations in the understorey characteristics of the vegetation communities;
- obtain more detailed information on the type of canopy species present at a site; and
- 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

How to use the Vegetation Community Profiles

The following provides a summary explanation of the vegetation community profiles presented in this report.

This number lets you know the number of field samples that have been used to classify the community

This number provides the mean number of native species recorded from each of the sites used to classify the community

MUXX Vegetation Community Name

Number of Sites: 6 No. taxa/plot: 48.5

❑ *DESCRIPTION*

This section summarises the abundant and frequently occurring plant species found in the community based on sample site data. The description provides a overview of the environmental characteristics of the community, in particular soil or geology type, elevation gradients and/or climatic features and spatial distribution within the special area. It also informs the reader of the community's conservation status under the NSW Threatened Species Conservation Act (1995) and known occurrence outside of the Special Area.

A photo from one of the sample sites is presented here as a means to illustrate the structural characteristics of the community

❑ *FLORISTIC SUMMARY*

Trees: *This section provides summary scores for upper heights (in metres) for the upper strata of the vegetation community. It also provides an estimation of the total projected canopy cover for this stratum. A standard deviation score is provided for this cover estimate. All values are generated from field site data.*

The dominant tree species are listed here. Example Species: Eucalyptus elata, Eucalyptus muelleriana, Eucalyptus radiata subsp. radiata, Eucalyptus cypellocarpa, Eucalyptus fastigata, Eucalyptus punctata

Shrubs: Upper Height 3m Projected Canopy Cover 15%

Example Species: Hibbertia aspera *subsp*. aspera, Leucopogon juniperinus, Persoonia linearis, Pittosporum revolutum, Zieria smithii, Dodonaea triquetra

Ground covers: Upper Height 0.5m, Projected Canopy Cover 65%

Example Species: Microlaena stipoides, Tylophora barbata, Lagenifera stipitata, Stypandra glauca, Pratia purpurascens, Clematis glycinoides *var*. glycinoides, Entolasia marginata, Entolasia stricta, Glycine microphylla, Adiantum aethiopicum, Desmodium varians, Dianella caerulea, Hydrocotyle peduncularis, Opercularia diphylla, Viola hederacea, Lomandra longifolia, Echinopogon caespitosus *var*. caespitosus

❑ *KEY IDENTIFYING FEATURES*

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

- *This section describes prominent (and conspicuous) plant species found in the community using common names. It also describes the important environmental factors that are associated with this vegetation community.*

❑ *EXAMPLE LOCATIONS*

Example locations of each community are from within the Special Area are presented here. For some communities a number of examples are given that lie outside the Special Area but are considered more accessible.

❑ *CONDITION ASSESSMENT*

RESERVATION STATUS

Total Area within Sydney Basin Bioregion (ha)	Proportion of Bioregional Area within NPWS Reserve (%)	Area within Catchment (ha)	Proportion of Bioregional Area within Catchmen
8114	29	6.57	0.1

This provides an overview of the known extent of the vegetation community within the catchments and the current area located within NPWS reserves

CONDITION ASSESSMENT

This section describes the intensity of disturbance features observed from aerial photo across the distribution of the vegetation community within the Special Area.

Disturbance Class	Area (ha)	Proportion Extant (%)
A Light	835.18	78.5
B Moderate	221.34	20.8
C Heavy	7.01	0.7
Total	1063.53	100

❑ *THREATENED PLANT SPECIES*

This section lists plant species that are on the NSW Threatened Species Act (1995) or are considered a Rare or Threatened Australian Plant (ROTAP) in Briggs and Leigh (1995).

❑ *DIAGNOSTIC SPECIES*

Diagnostic Species provides one method of quantitatively reviewing the performance of plant species within a given community as compared to all other communities found in the Special Areas. Site data has been used to understand the median cover abundance (using a 1-7 cover scale) and frequency of occurrence of all species within the community. Species that occur frequently and at higher cover scores have been highlighted as diagnostic species to help with the field identification of the community.

Species Name	Group Score	Group Freq	Non Group Score	Non Group Freq	Fidelity Class
Adiantum aethiopicum	5	0.67	2	0.22	positive
Allocasuarina torulosa	1	0.10	3	0.67	negative
Austrostipa pubescens	3	0.60	3	0.54	constant
Brunoniella pumilio	1	0.20	2	0.33	uninformative

This number presents the median cover score recorded for the species within sites used to classify the community. In this case a median score of 5 =25-50% cover

This provides the frequency of occurrence within sites used to classify the community. In this case the species has been found at 67% of sites

This number provides the median cover score for this species across all other communities in the special area. In this case the cover abundance is much lower in other communities (2= <5% cover)

This number tells you how frequently the species has been recorded in other groups. In this case other communities feature this species in 22% of sites

The fidelity class of the species has been classified as positive if it is unique to this community or it occurs more frequently and with higher median cover than all other communities found in the catchment. It is Negative if it is less abundant and less frequent in this community to other communities. It is constant if the species occurs as frequently and abundantly in all communities. Ot is uninformative if it is neither frequently recorded or abundant in sites.

MU1 Illawarra Escarpment Subtropical Rainforest

❑ *DESCRIPTION*

Illawarra Escarpment Subtropical Rainforest is scarce within the catchments and is restricted to several locations in the upper Cordeaux area. The forest is tall, often with billowing emergent rainforest trees rising over 35 metres in height, above a dense subcanopy. It has 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, although large figs are not common away from the escarpment edge. The subcanopy consists of species such as *Pennantia cunninghamii*, *Cryptocarya* spp., *Livistona australis*, *Polyosma cunninghamii, Acmena smithii* and *Doryphora sassafras*. An abundance of woody vines and lianas 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 reservoir 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. This includes the area of the Upper Cordeaux that has also been extensively cleared.

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 (2000b) “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*, *F. rubiginosa*) and *Cryptocarya* spp. (*C. glaucescens* and *C. microneura*).
- Predominance of rhizomatous fern species climbing on rocks, logs, lianas and tree trunks including Fragrant fern (*Microsorum scandens*) and *Arthropteris tenella.*
- An abundance of large woody vines or lianas 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 dependent herbs and ferns such as *Elatostema reticulatum* var. *reticulatum*, *Peperomia blanda* var. *floribunda* and Jungle brake (*Pteris umbrosa*).

❑ *EXAMPLE LOCATIONS*

Wattle Creek; Unnamed Creek off Wanyambilli Hill, Upper Cordeaux

❑ *CONSERVATION STATUS*

BIOREGIONAL STATUS

Total Area within Sydney Basin Bioregion (ha)	Proportion of Bioregional Area within NPWS Reserve (%)	Area within Catchment (ha)	Proportion of Bioregional Area within Catchment (%)
8114	29	6.57	0.1

CONDITION ASSESSMENT

Disturbance Class	Area (ha)	Proportion Extant (%)
A Light	1.30	19.8
B Moderate	0.46	7.0
C Heavy	4.81	73.2
Scattered trees	0	0
Total	6.57	100

❑ *THREATENED PLANT SPECIES*

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
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

Species Name	Group Score	Group Freq	Non Group Score	Non Group Freq	Fidelity Class
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 occurs on Narrabeen shales and sandstones in gully lines and protected slopes. The majority of its distribution occurs within the eastern extent of the Study Area where rainfall consistently exceeds mean annual levels of 1200 mm. This rainforest 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 adjoining Illawarra 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 into Shellharbour LGA (Mills, 2000). 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 and upper Cordeaux Rivers (Thomas, 1990). In deep gorges in the Nepean Catchment a depauperate form of rainforest occurs on Hawkesbury Sandstone. It retains a similar structure to the eastern vegetation but lacks many species such as *Cryptocarya* spp. and *Livistona australis* that require moister environments. Species such as *Acacia elata* and *Backhousia myrtifolia* are more commonly found.

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 Pepperbush (*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*

Flying Fox Creek, Avon Catchment; Bellambi Creek, Cataract Catchment; Avon River.

❑ *CONSERVATION STATUS*

BIOREGIONAL STATUS

Total Area within Sydney Basin Bioregion (ha)	Proportion of Bioregional Area within NPWS Reserve (%)	Area within Catchment (ha)	Proportion of Bioregional Area within Catchment (%)
>5000	14	1380.43	27.6

CONDITION ASSESSMENT

Disturbance Class	Area (ha)	Proportion Extant (%)
A Light	992.76	71.9
B Moderate	334.58	24.2
C Heavy	53.09	3.8
Scattered trees	0	0.0
Total	1380.43	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	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*

The Basalt geology that underlies the Robertson Plateau supports rainforest that differs from that found in other parts of the catchment. The canopy is dominated by *Doryphora sassafras* and *Acmena smithii* is present in combination with *Polyosma cunninghamii* and *Quintinia sieberi* at lower abundance. Lower shrubs of *Coprosma quadrifida* and *Diospyros australis* are often present. The ground cover contains a sparse cover of ferns including *Lastreopsis microsora* and *Microsorum pustulatum* subsp. *pustulatum*. As much of this rainforest appears to be regenerating from past disturbance it is rarely tall, 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 described as Robertson Rainforest listed on Part 3 of Schedule 1 of the Threatened Species Conservation Act (1995). Closely related rainforest assemblages are found on basalt caps above 1000 metres above sea level in Wollemi and Blue Mountains National Parks (Bell, 1998). These montane rainforests are located much further inland resulting in some minor floristic differences. Depauperate rainforest scrubs on basalt in Warragamba Special Area near Mt. Wanganderry are also closely related.

❑ *FLORISTIC SUMMARY*

Number of Sites: ***1***

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

Eucalyptus fastigata, 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, Coprosma quadrifida, Dicksonia antarctica

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 plateau at Robertson, small isolated patches.
- Dense canopy cover of Sassafras (*Doryphora sassafras*) and Lilly-pilly (*Acmena smithii*).
- Species characteristic of cooler rainforest environments such as Possumwood (*Quintinia sieberi*).

❑ *EXAMPLE LOCATIONS*

Macquarie Hill; Robertson Nature Reserve

❑ *CONSERVATION STATUS*

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

BIOREGIONAL STATUS

Total Area within Sydney Basin Bioregion (ha)	Proportion of Bioregional Area within NPWS Reserve (%)	Area within Catchment (ha)	Proportion of Bioregional Area within Catchment (%)
571	1.0	44.57	7.8

CONDITION ASSESSMENT

Disturbance Class	Area (ha)	Proportion Extant (%)
A Light	9.12	20.5
B Moderate	2.46	5.5
C Heavy	32.99	74.0
Scattered trees	0	0
Total	44.57	100

❑ *THREATENED PLANT SPECIES*

None recorded

❑ *DIAGNOSTIC SPECIES*

Species Name	Group Score	Group Freq	Non Group Score	Non Group Freq	Fidelity Class
Acacia melanoxylon	3	0.93	1	0.02	positive
Acmena smithii	4	0.57	2	0.05	positive
Aphanopetalum resinosum	1	0.50	0	0.00	positive
Blechnum patersonii subsp. patersonii	1	0.07	0	0.00	positive
Celastrus australis	1	0.79	0	0.00	positive
Clematis glycinoides	1	0.07	0	0.00	positive
Coprosma quadrifida	1	0.64	1	0.02	positive
Diplazium australe	1	0.07	0	0.00	positive
Doryphora sassafras	4	0.93	3	0.03	positive
Elatostema reticulatum	2	0.14	0	0.00	positive
Eustrephus latifolius	2	1.00	1	0.10	positive
Geranium potentilloides var. potentilloides	1	0.07	0	0.00	positive
Hydrocotyle algida	2	0.07	0	0.00	positive
Hymenanthera dentata	2	1.00	1	0.00	positive
Lastreopsis microsora subsp. microsora	2	0.50	2	0.02	positive
Marsdenia australis	1	0.07	0	0.00	positive
Marsdenia rostrata	2	0.79	1	0.03	positive
Olearia argophylla	1	0.07	0	0.00	positive
Pandorea pandorana subsp. pandorana	2	0.93	1	0.00	positive
Parsonsia brownii	2	0.79	1	0.00	positive
Pimelea ligustrina	1	0.07	0	0.00	positive
Pittosporum multiflorum	2	0.71	2	0.02	positive
Polystichum proliferum	1	0.14	0	0.00	positive
Pyrrosia rupestris	2	0.86	2	0.03	positive
Corymbia gummifera	0	0.00	2	0.53	negative
Entolasia stricta	0	0.00	2	0.55	negative

MU4 Sandstone Riparian Scrub

❑ *DESCRIPTION*

A low mesic scrub less than five metres tall occurs along deeply incised creeklines on Hawkesbury Sandstones across the Woronora Plateau. The Riparian Scrub features a variable cover of shrubs that include *Tristaniopsis laurina*, *Tristania neriifolia*, *Leptospermum morrisonii*, *Allocasuarina littoralis*, *Ceratopetalum apetalum* and *Backhousia myrtifolia*. The latter two species tend to be more prominent amongst stream boulders (Keith, 1994) and around minor waterfalls. The smaller shrub layer is dominated by *Lomatia myricoides* with *Acacia obtusifolia*, *Grevillea oleoides*, *Micrantheum hexandrum*, *Pseudanthus pimeleoides* and *Bauera rubioides*. The ground cover consists of an abundant cover of moisture loving ferns such *as Sticherus flabellatus* var. *flabellatus* and *Gleichenia microphylla*. The fern cover is often broken by a series of rock pools, recent sandy alluvial deposits and rock pavements. Branches of the surrounding Eucalypt forest form an occasional shade cover across the gully line. Tree species are vary between locations but are frequently *Eucalyptus piperita*, *E. agglomerata* or *Angophora costata*. Sandstone Riparian Scrub occurs in Woronora, O'Hares, Cataract, Cordeaux and Nepean Catchments. In many instances this community occurs in narrow bands which are too small to map. This is particularly the case with minor streams that are confluent with major creeks. Sandstone Riparian Scrub is also found in Holsworthy Military Area (French *et al*., 2000) and Royal National Park (Keith, 1994). Elsewhere in the Sydney Basin Bioregion it has been recorded in Wollemi and Yengo National Park (Bell, 1998) and would be expected to occur in several additional sandstone reserves to the south and east. A small area has been identified in the Warragamba Catchment (NPWS, 2003)

❑ *FLORISTIC SUMMARY*

Number of Sites: ***4***

Trees: 20-30m tall. Mean Projected Canopy Cover 5%

Angophora costata, Eucalyptus piperita, Eucalyptus punctata, Eucalyptus pilularis

Taller Shrubs: 2-5m tall. Mean Projected Canopy Cover 40%

Tristaniopsis laurina, Tristania neriifolia, Ceratopetalum apetalum, Leptospermum morrisonii, Allocasuarina littoralis, Dodonaea triquetra, Acacia irrorata subsp. *irrorata, Callicoma serratifolia*

Shrubs: 0.5-1.5 m tall. Mean Projected Canopy Cover 30%

Lomatia myricoides, Acacia obtusifolia, Grevillea oleoides, Bauera rubioides, Micrantheum hexandrum, Prostanthera linearis, Hakea salicifolia

Ground covers: 0.5-1m tall. Mean Projected Canopy Cover 35%

Sticherus flabellatus var. *flabellatus, Gleichenia microphylla, Schoenus melanostachys, Lepidosperma laterale, Lomandra fluviatilis, Lomandra longifolia, Entolasia stricta*

❑ *KEY IDENTIFYING FEATURES*

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

- Gully line habitat on Hawkesbury Sandstone. Rock pools, waterfalls, rock platforms and sandy banks are regularly observed along creek lines.
- Water gums (*Tristaniopsis laurina, Tristania neriifolia*) are the prominent feature of this community. They are generally low in height although where there is greater shelter, the community is slightly taller and includes Coachwood (*Ceratopetalum apetalum*) and Grey myrtle (*Backhousia myrtifolia*).
- Dense cover of ferns including the Umbrella fern (*Sticherus flabellatus* var. *flabellatus*) and the Scrambling coral fern (*Gleichenia microphylla*).

❑ *EXAMPLE LOCATIONS*

O'Hares Creek, Stokes Creek (O'Hares Catchment); Cataract Creek (Cataract Catchment), Flat Rock Crossing (Woronora Catchment)

❑ *CONSERVATION STATUS*

BIOREGIONAL STATUS

Total Area within Sydney Basin Bioregion (ha)	Proportion of Bioregional Area within NPWS Reserve (%)	Area within Catchment (ha)	Proportion of Bioregional Area within Catchment (%)
>1500	65	531.01	35.4

CONDITION ASSESSMENT

Disturbance Class	Area (ha)	Proportion Extant (%)
A Light	530.58	99.9
B Moderate	0	0
C Heavy	0.43	0.1
Scattered trees	0	0
Total	531.01	100

❑ *THREATENED PLANT SPECIES*

Grevillea longifolia (2RC-), *Lomandra fluviatilis* (3RCa)

❑ *DIAGNOSTIC SPECIES*

Species Name	Group Score	Group Freq	Non Group Score	Non Group Freq	Fidelity Class
Acacia obtusifolia	4	1.00	2	0.12	positive
Allocasuarina littoralis	2	0.50	1	0.14	positive
Austromyrtus tenuifolia	2	0.17	0	0.00	positive
Bauera rubioides	2	0.67	2	0.07	positive
Beyeria lasiocarpa	1	0.17	0	0.00	positive
Dodonaea triquetra	3	0.50	2	0.12	positive
Gleichenia microphylla	4	0.50	3	0.04	positive
Grevillea oleoides	2	0.83	2	0.24	positive
Guringalia dimorpha	2	0.83	2	0.07	positive
Leptospermum morrisonii	2	0.83	1	0.01	positive
Lomandra fluviatilis	3	0.83	1	0.02	positive
Lomatia myricoides	3	1.00	1	0.03	positive
Ludwigia peploides subsp. montevidensis	1	0.17	0	0.00	positive
Micrantheum hexandrum	4	0.50	0	0.00	positive
Philydrum lanuginosum	1	0.17	0	0.00	positive
Pseudanthus pimeleoides	2	0.83	1	0.01	positive
Sticherus flabellatus var. flabellatus	4	0.67	2	0.04	positive
Tristania neriifolia	3	0.83	1	0.01	positive
Tristaniopsis laurina	3	0.83	3	0.02	positive
Corymbia gummifera	0	0.00	2	0.52	negative
Entolasia stricta	2	0.67	2	0.53	constant

MU5 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 Coachwood Warm Temperate 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 above sea level, *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 Stanwell Park and Kiama.

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 (MU4). Within the catchments it is restricted to a number of isolated tiny patches along the eastern escarpment.

❑ *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; Sublime Point Lookout.

❑ *CONSERVATION STATUS*

BIOREGIONAL STATUS

Total Area within Sydney Basin Bioregion (ha)	Proportion of Bioregional Area within NPWS Reserve (%)	Area within Catchment (ha)	Proportion of Bioregional Area within Catchment (%)
>125	6.5	1.88	1.5

CONDITION ASSESSMENT

Disturbance Class	Area (ha)	Proportion Extant (%)
A Light	1.88	100
B Moderate	0	0
C Heavy	0	0
Scattered trees	0	0
Total	1.88	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

Species Name	Group Score	Group Freq	Non Group Score	Non Group Freq	Fidelity Class
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
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

MU6 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 species include *Doryphora sassafras*, *Cryptocarya glaucescens* and *Acmena smithii*. Shrubs include *Trochocarpa laurina*, *Pittosporum multiflorum*, *Breynia oblongifolia* and *Synoum glandulosum* subsp. *glandulosum* and Treeferns (*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 consists of 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 mark the Escarpment Blue Gum Forests (NPWS, 2002) 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. Further work is required to examine relationships between similar forests occurring on shale soils of northern Sydney and the Watagan Ranges on the Central Coast.

❑ *FLORISTIC SUMMARY*

Number of sites: ***12***

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

Eucalyptus salignaXbotryoides, Eucalyptus pilularis, 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, Cordeaux and Cataract.
- Tall Blue gums (*Eucalyptus saligna, E. salignaXbotryoides, E. botryoides*) in combination with Blackbutt (*Eucalyptus pilularis*) and Turpentine (*Syncarpia glomulifera* subsp. *glomulifera*).
- A tall subcanopy of rainforest species dominated by Lilly pilly (*Acmena smithii*), Coachwood (*Ceratopetalum apetalum*), Bolwarra (*Eupomatia laurina*) and Sassafras (*Doryphora sassafras*).

❑ *EXAMPLE LOCATIONS*

Bellambi Creek, Cataract Catchment; Picton Road Interchange, Cataract Catchment

❑ *CONSERVATION STATUS*

BIOREGIONAL STATUS

Total Area within Sydney Basin Bioregion (ha)	Proportion of Bioregional Area within NPWS Reserve (%)	Area within Catchment (ha)	Proportion of Bioregional Area within Catchment (%)
>1200	3.9	832.75	69.4

CONDITION ASSESSMENT

Disturbance Class	Area (ha)	Proportion Extant (%)
A Light	375.77	45.1
B Moderate	344.55	41.4
C Heavy	65.67	7.9
Scattered trees	46.50	5.6
Total	832.75	100

❑ *THREATENED PLANT SPECIES*

Hibbertia nitida (2RC-)

❑ *DIAGNOSTIC SPECIES*

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

Species Name	Group Score	Group Freq	Non Group Score	Non Group Freq	Fidelity Class
Cryptocarya glaucescens	3	0.67	2	0.03	positive
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

MU7 Moist Coastal White Box Forest

❑ *DESCRIPTION*

Moist Coastal White Box Forest forms a minor component of the vegetation found within the catchments. It is a tall mesic Eucalypt forest dominated by *Eucalyptus quadrangulata* and is prominent on the Illawarra Escarpment south of Mt. Kembla. 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 and 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 consists of a profusion of vines and a ferny ground layer. Within the catchments Moist Coastal White Box occurs on the escarpment edge on the eastern boundary of the Cordeaux catchment.

Within the region, the occurrence of *E. quadrangulata* as a dominant tree species above a mature Warm Temperate-Subtropical rainforest subcanopy appears restricted to the escarpment slopes of the Illawarra 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 data from Royal National Park, Western Sydney and the Lower Hunter and Central Coast.

❑ *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 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*

BIOREGIONAL STATUS

Total Area within Sydney Basin Bioregion (ha)	Proportion of Bioregional Area within NPWS Reserve (%)	Area within Catchment (ha)	Proportion of Bioregional Area within Catchment (%)
>3000	5.7	6.76	0.2

CONDITION ASSESSMENT

Disturbance Class	Area (ha)	Proportion Extant (%)
A Light	4.06	60.1
B Moderate	1.00	14.8
C Heavy	1.7	25.1
Scattered trees	0	0
Total	6.76	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

MU8 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 *Doryphora sassafras*, *Livistona australis*, *Cryptocarya* spp., *Acmena smithii* and *Eupomatia laurina*. The understorey consists of 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.

Moist Gully Gum Forest is widespread on protected slopes and gullies underlain by Narrabeen Sandstones found in the east of the plateau. Small isolated patches occur on shale outcropping in drier environments of the Nepean Catchment. Outside of the Special Areas, 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 Coastal 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 ecosystem that is well protected in the reserve system.

❑ *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, Doryphora sassafras, 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 canopy and the presence of Gully gum (*Eucalyptus smithii*) and Yellow stringybark (*E. muelleriana*).
- A mesic subcanopy tree-layer including Scentless rosewood (*Synoum glandulosum* subsp. *glandulosum*), Sassafras (*Doryphora sassafras*), 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. Little Wattle Creek below Trail 6D, Southerly aspects below Trail 15c.

❑ *CONSERVATION STATUS*

BIOREGIONAL STATUS

Total Area within Sydney Basin Bioregion (ha)	Proportion of Bioregional Area within NPWS Reserve (%)	Area within Catchment (ha)	Proportion of Bioregional Area within Catchment (%)
>2736	46	1202.29	43.9

CONDITION ASSESSMENT

Disturbance Class	Area (ha)	Proportion Extant (%)
A Light	821.49	68.3
B Moderate	291.04	24.2
C Heavy	61.40	5.1
Scattered trees	28.36	2.4
Total	1202.29	100

❑ *THREATENED PLANT SPECIES*

None recorded

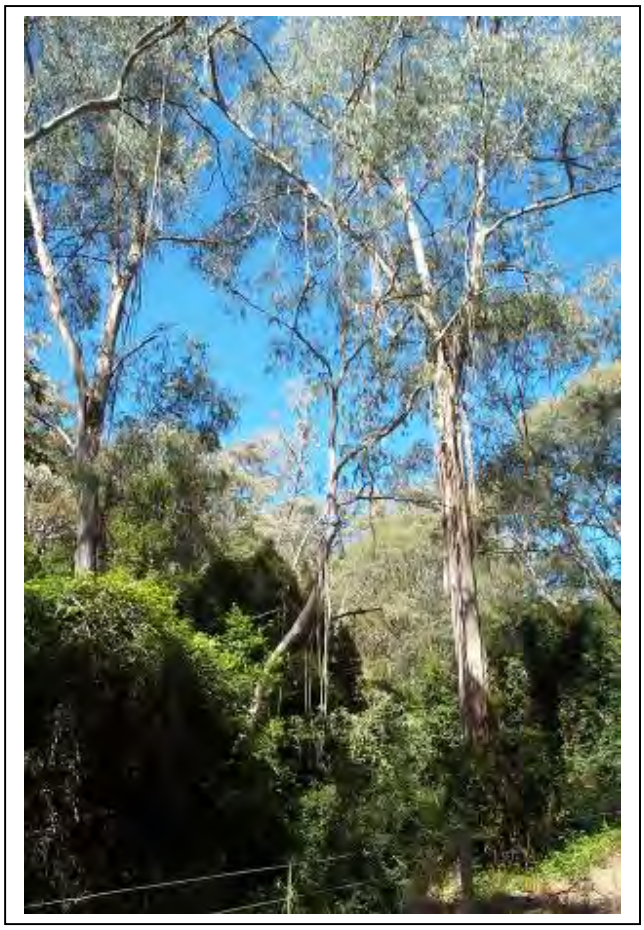
❑ *DIAGNOSTIC SPECIES*

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
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

MU9 Nepean Gorge Moist Forest

❑ *DESCRIPTION*

The Nepean Catchment is characterised by a number of deeply dissected Hawkesbury sandstone gorges and valleys. A tall forest with a moist subcanopy occupies sheltered aspects in these environments. Tall *Eucalyptus elata* are a feature of the canopy. Other canopy species include *Eucalyptus agglomerata*, *E. punctata* and *E. piperita*. The understorey can be a moderately tall small tree and shrub layer. In the most protected sites *Ceratopetalum apetalum*, *Backhousia myrtifolia, C. gummiferum* and *Acacia elata* can grow up to around twelve metres in height. The smaller shrub stratum is less dense. It includes ferns, such as *Cyathea australis*, and shrubs, such *as Elaeocarpus reticulatus* and *Notelaea longifolia* f. *longifolia*. The shady habitat provides sufficient shelter for an abundant ground cover of ferns such as *Calochlaena dubia*, *Pteridium esculentum*, *Sticherus flabellatus* var. *flabellatus*, *Blechnum cartilagineum* and *Adiantum formosum*. Small succulent climbers such as *Tylophora barbata* and *Cissus hypoglauca* are also abundant.



Deep gorges that run east-west provide sufficient shelter for narrow ribbons of this moist forest. The composition of the moist understorey is less diverse than other moist forests found in the eastern catchments. Nepean Gorge Moist Forest more closely resembles moist Blue Gum Forests found in similar habitats in Nattai National Park in the Warragamba Special Area.

❑ *FLORISTIC SUMMARY*

Number of Sites: 1

Trees: 25-35m tall. Projected Cover 40%

Eucalyptus elata, Eucalyptus agglomerata, Eucalyptus punctata, Eucalyptus piperita, Corymbia gummifera

Tall Shrubs: 6-12m. Mean Projected Cover 35%

Acacia elata, Ceratopetalum apetalum, Ceratopetalum gummiferum, Backhousia myrtifolia

Small Shrubs: 2-5m. Projected Cover 15%

Cyathea australis, Breynia oblongifolia, Elaeocarpus reticulatus, Persoonia linearis, Pultenaea flexilis, Leptospermum polygalifolium subsp. *polygalifolium, Leucopogon lanceolatus* var. *lanceolatus, Tristaniopsis collina*

Ground covers: 0-0.5 m tall. Mean Projected Canopy Cover 70%

Calochlaena dubia, Pteridium esculentum, Dianella caerulea, Lomandra longifolia, Lepidosperma laterale, Entolasia marginata, Billardiera scandens, Viola hederacea, Clematis aristata

❑ *KEY IDENTIFYING FEATURES*

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

- Deeply dissected gorges and valleys of the Mittagong and Hawkesbury Sandstones in the western Metropolitan Catchment.
- A tall forest supporting River peppermint (*Eucalyptus elata*), Grey gum (*E. punctata*) and Blue-leaved stringybark (*E. agglomerata*).
- Small trees such as Mountain cedar wattle (*Acacia elata*), Christmas bush (*Ceratopetalum gummiferum*), Coachwood (*C. apetalum*) and Grey myrtle (*Backhousia myrtifolia*).
- A shrubby understorey of Blueberry ash (*Elaeocarpus reticulatus*), Tea-tree (*Leptospermum polygalifolium* subsp. *polygalifolium*), Bearded heath (*Leucopogon lanceolatus* var. *lanceolatus*) and Native olive (*Notelaea longifolia* f. *longifolia*).
- The ground cover has a prominent cover of Common ground fern (*Calochlaena dubia*), Bracken (*Pteridium esculentum*), Spiny-headed mat-rush (*Lomandra longifolia*) and Snowgrass (*Poa sieberiana* var. *sieberiana*).

❑ *EXAMPLE LOCATIONS*

Avon Dam Road, Nepean Catchment; Gullyline below Fire Trail 3D, Nepean Catchment

❑ *CONSERVATION STATUS*

BIOREGIONAL STATUS

Total Area within Sydney Basin Bioregion (ha)	Proportion of Bioregional Area within NPWS Reserve (%)	Area within Catchment (ha)	Proportion of Bioregional Area within Catchment (%)
3000	50	417.48	13.9

CONDITION ASSESSMENT

Disturbance Class	Area (ha)	Proportion Extant (%)
A Light	417.48	100
B Moderate	0	0
C Heavy	0	0
Scattered Trees	0	0
Total	417.48	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	0.60	2	0.21	positive
Blechnum cartilagineum	4	1.00	3	0.11	positive
Callicoma serratifolia	4	0.70	2	0.02	positive
Calochlaena dubia	6	0.90	3	0.07	positive
Ceratopetalum apetalum	5	0.70	4	0.03	positive
Ceratopetalum gummiferum	4	0.50	4	0.03	positive
Clematis aristata	2	0.50	2	0.35	positive
Elaeocarpus reticulatus	3	0.70	1	0.16	positive
Eucalyptus elata	4	0.60	4	0.06	positive
Geitonoplesium cymosum	2	0.50	2	0.29	positive
Hymenophyllum cupressiforme	2	0.50	2	0.02	positive
Morinda jasminoides	2	0.60	2	0.06	positive
Pteridium esculentum	2	0.70	2	0.36	positive
Smilax glyciphylla	2	0.50	1	0.07	positive
Sticherus flabellatus var. flabellatus	4	0.50	3	0.01	positive
Todea barbara	4	0.50	2	0.01	positive
Viola hederacea	2	0.50	2	0.24	positive
Lomandra longifolia	2	0.60	2	0.55	constant

MU10 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 the herbs *Dichondra repens* and *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. *stipoides, 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 Robertson Plateau.
- A tall small tree layer of Blackwood (*Acacia melanoxylon*).
- A moist shrub understorey that includes Treeferns (*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.

BIOREGIONAL STATUS

Total Area within Sydney Basin Bioregion (ha)	Proportion of Bioregional Area within NPWS Reserve (%)	Area within Catchment (ha)	Proportion of Bioregional Area within Catchment (%)
935	0.2	505.50	54.1

CONDITION ASSESSMENT

Disturbance Class	Area (ha)	Proportion Extant (%)
A Light	179.72	35.6
B Moderate	30.18	6.0
C Heavy	71.56	14.2
Scattered Trees	224.04	44.3
Total	505.50	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

Species Name	Group Score	Group Freq	Non Group Score	Non Group Freq	Fidelity Class
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
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

MU11 Moist Shale Messmate Forest

❑ *DESCRIPTION*

Moist Shale Messmate Forest occurs on soils derived from Wianamatta Shale at elevations above 600 metres. Typically this community is found on the eastern extent of the Robertson Plateau where rainfall levels are highest. It also occupies sites where some shelter is provided by slopes and gullies. The tall forest canopy comprises combinations of *Eucalyptus obliqua*, *E. cypellocarpa*, *E. smithii, E. muelleriana, E. fastigata* and less frequently *E. piperita* and *E. globoidea*. The shrub and small tree layer is typified by some mesic species such as *Acmena smithii, Coprosma quadrifida, Ceratopetalum apetalum*, *Acacia melanoxylon* and *Cyathea australis*. Other shrub species include *Acacia binervata* and *Leucopogon lanceolatus* var. *lanceolatus*. The 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*. The ground covers include *Fieldia australis,* and the ferns *Blechnum cartilagineum* and *Calochlaena dubia.*

Within the Study Area this community is closely related to Robertson Basalt Brown Barrel Forest and Highlands Shale Tall Open Forest. The former however is strongly related to Basalt geologies rather than shale. The latter is also a drier forest that exhibits greater influence of underlying sandstone in the floristic composition. Moist Shale Messmate Forest closely resembles 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 Ecosystem is located within reserves. However, within the Southern Highlands, Moist Shale Messmate Forest is a component of Robertson Basalt Tall Open-forest, an Endangered Ecological Community listed under the Threatened Species Conservation Act, 1995.

❑ *FLORISTIC SUMMARY*

Number of Sites: 4

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

Eucalyptus obliqua, Eucalyptus muelleriana, Eucalyptus cypellocarpa, Eucalyptus smithii, Eucalyptus fastigata, Eucalyptus globoidea, Eucalyptus piperita

Small Trees and Shrubs: 1-8m tall. Mean Projected Canopy Cover 5%

Acmena smithii, Acacia melanoxylon, Ceratopetalum apetalum, Cyathea australis, Acacia binervata, Leucopogon lanceolatus var*. lanceolatus, Coprosma quadrifida*

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

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

Vines & Climbers:

Tylophora barbata, Clematis aristata, Marsdenia rostrata, Eustrephus latifolius, Glycine clandestina

❑ *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 following: Mountain grey gum (*Eucalyptus cypellocarpa*), Yellow stringybark (*E. muelleriana*), Messmate (*E. obliqua*), White stringybark (*E. globoidea*) and Sydney peppermint (*E. piperita*).
- The presence of moist shrub species Lilly pilly (*Acmena smithii*), Coachwood (*Ceratopetalum apetalum*) and Rough treefern (*Cyathea australis*) with other shrubs such as Lance-leaf beard-heath (*Leucopogon lanceolatus* var. *lanceolatus*) and Two-veined hickory (*Acacia binervata*).
- A diverse herbaceous understorey containing species such as Bracken (*Pteridium esculentum*), Whiteroot (*Pratia purpurascens*), Spiny-headed mat-rush (*Lomandra longifolia*), Paroo lily (*Dianella caerulea*), Native violet (*Viola hederacea*), Raspwort (*Gonocarpus teucrioides*), *Poranthera microphylla*, Bordered panic (*Entolasia marginata*), Climbing guinea flower (*Hibbertia scandens*), Kidney weed (*Dichondra repens*) and *Lagenifera stipitata.*

❑ *EXAMPLE LOCATIONS*

Macquarie Hill; Moresby Hill, near Robertson, Tourist Road, Robertson.

❑ *CONSERVATION STATUS*

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

BIOREGIONAL STATUS

Total Area within Sydney Basin Bioregion (ha)	Proportion of Bioregional Area within NPWS Reserve (%)	Area within Catchment (ha)	Proportion of Bioregional Area within Catchment (%)
8769	11	726.75	8.3

CONDITION ASSESSMENT

Disturbance Class	Area (ha)	Proportion Extant (%)
A Light	589.41	81.1
B Moderate	34.42	4.7
C Heavy	20.51	2.8
Scattered trees	82.41	11.3
Total	726.75	100

❑ *THREATENED PLANT SPECIES*

None recorded

❑ *DIAGNOSTIC SPECIES*

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
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
Corymbia gummifera	0	0.00	2	0.55	negative

MU12 Highlands Ribbon Gum Gully Forest

❑ *DESCRIPTION*

Highlands Ribbon Gum Gully Forest occurs in deeper gully lines on shale soils or shale enriched sandstone gullies nearby. It is restricted to the far south-western corner of the Nepean Catchment, although it extends into remnant gullies of the Southern Highlands Shale Plateau. It is a tall forest dominated by *Eucalyptus viminalis* often in combination with *E. elata* and *Angophora floribunda* immediately adjoining the creekline. The shrub layer consists of several layers of mesic species. The taller shrubs are small trees of *Acacia binervata* and *Pittosporum undulatum*, with smaller shrub species including *Leucopogon juniperinus* and *Indigofera australis*. Ground cover generally consists of *Pteridium esculentum* and *Lomandra longifolia*.

Highlands Ribbon Gum Gully Forest is a component of Grassy Shale and Basalt Forests found in the cool, high elevations of the Southern Highlands. It is closely related to Map Unit 11 and 10 and as such forms part of the Endangered Ecological Community Southern Highlands Shale Woodlands.

❑ *FLORISTIC SUMMARY*

Number of Sites: ***None***

Trees: 6-10m tall. Mean Projected Canopy Cover 10%

Eucalyptus viminalis, Eucalyptus elata, Angophora floribunda, Eucalyptus cypellocarpa

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

Acacia binervata, Indigofera australis, Cyathea australis, Leucopogon juniperinus, Acacia obtusifolia

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

Pteridium esculentum, Lomandra longifolia, Desmodium varians, Dichondra repens

❑ *KEY IDENTIFYING FEATURES*

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

- Tall to very tall Ribbon gum (*Eucalyptus viminalis*) forest that follows major creeks and rivers on the rich soils of the Southern Highlands.

❑ *EXAMPLE LOCATIONS*

Fire Trail 2D Chalkers Crossing, Nepean River (Nepean Catchment)

❑ *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).

BIOREGIONAL STATUS

Total Area within Sydney Basin Bioregion (ha)	Proportion of Bioregional Area within NPWS Reserve (%)	Area within Catchment (ha)	Proportion of Bioregional Area within Catchment (%)
>527	0	527.29	100

CONDITION ASSESSMENT

Disturbance Class	Area (ha)	Proportion Extant (%)
A Light	487.61	92.5
B Moderate	4.45	0.8
C Heavy	0	0
Scattered Trees	35.23	6.7
Total	527.29	100

❑ *THREATENED PLANT SPECIES*

None recorded

❑ *DIAGNOSTIC SPECIES*

No Diagnostic Species List available as no survey sites were undertaken in this community.

MU13 Tall Open Gully Gum Forest

❑ *DESCRIPTION*

Tall Open Gully Gum Forest occurs on exposed slopes and crests on Narrabeen Shale and Sandstone in the eastern 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. The shrub layer is otherwise 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*. Vines and twiners are common and include *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 catchments. It represents the drier end of the gradient from Moist Gully Gum Forest (Map Unit 8) as a result of its exposure to fire and drying winds. The distribution of this map unit outside of the Special Areas is poorly known.

❑ *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-headed mat-rush (*Lomandra longifolia*), Bracken (*Pteridium esculentum*) and *Calochlaena dubia.*
- A high diversity of vines and twiners 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*

BIOREGIONAL STATUS

Total Area within Sydney Basin Bioregion (ha)	Proportion of Bioregional Area within NPWS Reserve (%)	Area within Catchment (ha)	Proportion of Bioregional Area within Catchment (%)
1160	0.7	1150.67	99

CONDITION ASSESSMENT

Disturbance Class	Area (ha)	Proportion Extant (%)
A Light	772.28	67.1
B Moderate	313.25	27.2
C Heavy	62.30	5.4
Scattered Trees	2.84	0.2
Total	1150.67	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
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

MU14 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 *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*

BIOREGIONAL STATUS

Total Area within Sydney Basin Bioregion (ha)	Proportion of Bioregional Area within NPWS Reserve (%)	Area within Catchment (ha)	Proportion of Bioregional Area within Catchment (%)
1552	0.2	1549.12	100

CONDITION ASSESSMENT

Disturbance Class	Area (ha)	Proportion Extant (%)
A Light	918.56	59.3
B Moderate	488.23	31.5
C Heavy	140.45	9.1
Scattered trees	1.88	0.1
Total	1549.12	100

❑ *THREATENED PLANT SPECIES*

Lomandra fluviatilis (3RCa)

❑ *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

MU15 Tall Open Blackbutt Forest

❑ *DESCRIPTION*

Tall Open Blackbutt Forest occurs on Narrabeen Shales and Sandstones along the eastern 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. salignaXbotryoides*. 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 Illawarra Escarpment. Examples of these are patchy as so 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 Ac*acia 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 f. *longifolia, Persoonia linearis, Leucopogon lanceolatus* var. *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 7D (Sandstone influence understorey); Clive Bissell Drive, western side of Road.

❑ *CONSERVATION STATUS*

BIOREGIONAL STATUS

Total Area within Sydney Basin Bioregion (ha)	Proportion of Bioregional Area within NPWS Reserve (%)	Area within Catchment (ha)	Proportion of Bioregional Area within Catchment (%)
2410	59	968.99	40.2

CONDITION ASSESSMENT

Disturbance Class	Area (ha)	Proportion Extant (%)
A Light	771.61	79.6
B Moderate	152.59	15.7
C Heavy	44.79	4.6
Scattered Trees	0	0
Total	968.99	100

❑ *THREATENED PLANT SPECIES*

Pultenaea aristata (V)

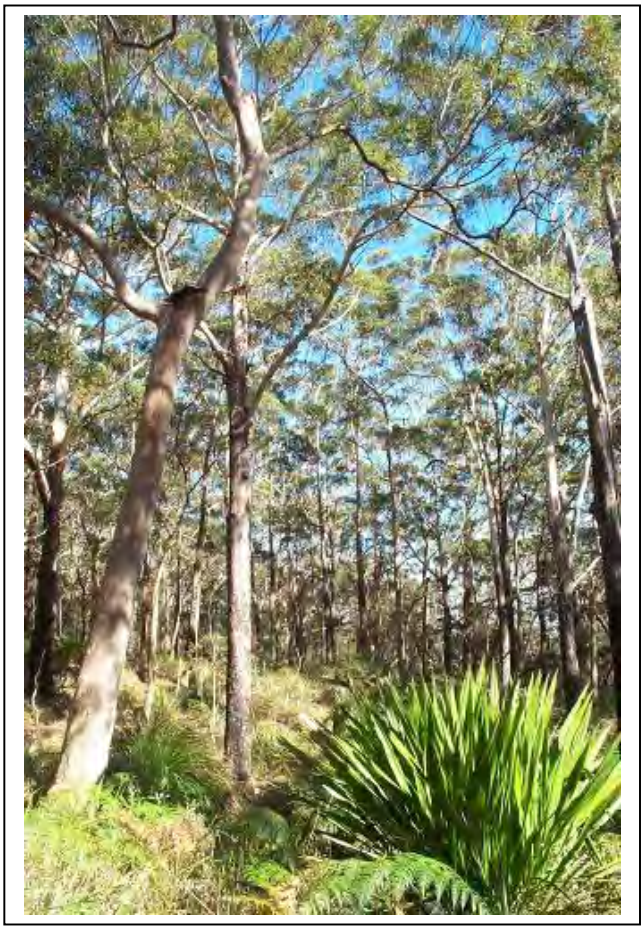
❑ *DIAGNOSTIC SPECIES*

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

Species Name	Group Score	Group Freq	Non Group Score	Non Group Freq	Fidelity Class
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

MU16 Tall Blackbutt-Apple Shale Forest

❑ *DESCRIPTION*



Tall Blackbutt-Apple Shale Forest occurs on remnant shale caps in a small area along the eastern boundary of the Woronora Catchment. It is more extensively distributed to the east in 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*, *Leptomeria acida*, *Persoonia linearis*, *Leptospermum polygalifolium* subsp. *polygalifolium* 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 consists of 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*

BIOREGIONAL STATUS

Total Area within Sydney Basin Bioregion (ha)	Proportion of Bioregional Area within NPWS Reserve (%)	Area within Catchment (ha)	Proportion of Bioregional Area within Catchment (%)
379	91	24.55	6.5

CONDITION ASSESSMENT

Disturbance Class	Area (ha)	Proportion Extant (%)
A Light	7.13	29.0
B Moderate	16.71	68.1
C Heavy	0	0
Scattered Trees	0.71	2.9
Total	24.55	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

MU17 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. Smaller isolated patches are also found along Appin Road and in the Cataract Catchment on Fire Trails 7A. 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 mat-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).

BIOREGIONAL STATUS

Total Area within Sydney Basin Bioregion (ha)	Proportion of Bioregional Area within NPWS Reserve (%)	Area within Catchment (ha)	Proportion of Bioregional Area within Catchment (%)
286	8.2	285.47	100

CONDITION ASSESSMENT

Disturbance Class	Area (ha)	Proportion Extant (%)
A Light	25.98	89.0
B Moderate	0	0
C Heavy	0	0
Scattered Trees	31.49	11.0
Total	285.47	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

MU18 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. At Cupitts Forest and adjoining the Burke River, isolated occurrences of *Eucalyptus amplifolia* subsp. *amplifolia* are also present. *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*.

Highlands Shale Tall Open Forest is thought to have been extensively distributed across Wianamatta Shale found on the Southern Highlands (Eco Logical 2002). This community forms a component of Southern Highlands Shale Woodlands, an Endangered Ecological Community, listed under Part 3 of Schedule 1 of the Threatened Species Conservation Act (1995) as part of Southern Highlands Shale Woodlands.

❑ *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 6-15m tall. Mean Projected Canopy Cover 20%

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, Poa sieberiana

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 Mountain grey 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 (Avon and Nepean Catchments)

❑ *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.

BIOREGIONAL STATUS

Total Area within Sydney Basin Bioregion (ha)	Proportion of Bioregional Area within NPWS Reserve (%)	Area within Catchment (ha)	Proportion of Bioregional Area within Catchment (%)
8769	0.04	3435.25	39.2

CONDITION ASSESSMENT

Disturbance Class	Area (ha)	Proportion Extant (%)
A Light	2643.90	77.0
B Moderate	214.19	6.2
C Heavy	120.97	3.5
Scattered Trees	456.19	13.3
Total	3435.25	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

MU19 Transitional Shale Open Blue Gum Forest

❑ *DESCRIPTION*

In the Cataract Catchment a residual shale cap supports a tall stand of *Eucalyptus salignaXbotryoides*. This forest is closely related to other Tall Open Forests found throughout the Study Area. The lower rainfall in the western part of the catchment supports an understorey composition that most resembles other Shale Sandstone Transition Forests found further west and south. The ground cover includes a diverse cover of herbs such as *Hydrocotyle laxiflora*, *Pratia purpurascens* and *Dichondra repens* along with grasses, such as *Entolasia marginata*. *Acacia irrorata* subsp. *irrorata* and *Leptospermum polygalifolium* subsp. *polygalifolium* were most prominent in the shrub stratum of the sample site.

Transitional Shale Open Blue Gum Forest form a component of Shale-Sandstone Transition Forest, an Endangered Ecological Community listed under Part 3, Schedule 1 of the Threatened Species Conservation Act, 1995.

❑ *FLORISTIC SUMMARY*

Number of Sites: ***1***

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

Eucalyptus salignaXbotryoides

Small Trees 5-10m tall.Mean Projected Canopy Cover 5%

Acacia irrorata subsp. *irrorata*

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

Leptospermum polygalifolium subsp. *polygalifolium*

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

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

Vines and Twiners:

Tylophora barbata, Marsdenia rostrata

❑ *KEY IDENTIFYING FEATURES*

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

- Isolated shale cap on Fire Trail 8.
- Tall straight trees, usually Sydney blue gum (*Eucalyptus salignaXbotyriodes*).

❑ *EXAMPLE LOCATIONS*

Fire Trail 8, Cataract Catchment; Cataract Dam Picnic Area (now mostly cleared).

❑ *CONSERVATION STATUS*

Listed as an Endangered Ecological Community under Part 3 of Schedule 1 of the Threatened Species Conservation Act (1995), as part of Shale-Sandstone Transition Forest.

BIOREGIONAL STATUS

Total Area within Sydney Basin Bioregion (ha)	Proportion of Bioregional Area within NPWS Reserve (%)	Area within Catchment (ha)	Proportion of Bioregional Area within Catchment (%)
3324	0.5	35.56	1.1

CONDITION ASSESSMENT

Disturbance Class	Area (ha)	Proportion Extant (%)
A Light	33.56	100
B Moderate	0	0
C Heavy	0	0
Scattered Trees	0	0
Total	33.56	100

❑ *THREATENED PLANT SPECIES*

None recorded

❑ *DIAGNOSTIC SPECIES*

(*Note that only one sample site has been used to develop the diagnostic species list below*)

Species Name	Group Score	Group Freq	Non Group Score	Non Group Freq	Fidelity Class
Desmodium varians	2	1	2	0.05	positive
Dianella caerulea	2	1	2	0.29	positive
Dichondra repens	3	1	2	0.07	positive
Entolasia marginata	3	1	2	0.23	positive
Eucalyptus saligna	4	1	3	0.04	positive
Galium propinquum	2	1	2	0.04	positive
Geranium homeanum	2	1	1	0.02	positive
Glycine clandestina	2	1	1	0.13	positive
Glycine tabacina	2	1	2	0.04	positive
Gonocarpus teucrioides	3	1	2	0.36	positive
Helichrysum elatum	2	1	1	0.04	positive
Hibbertia diffusa	2	1	1	0.02	positive
Hydrocotyle laxiflora	2	1	2	0.04	positive
Hydrocotyle peduncularis	2	1	2	0.03	positive
Lagenifera stipitata	2	1	2	0.09	positive

Species Name	Group Score	Group Freq	Non Group Score	Non Group Freq	Fidelity Class
Leptospermum polygalifolium subsp. polygalifolium	2	1	2	0.18	positive
Leucopogon juniperinus	2	1	1	0.02	positive
Marsdenia rostrata	2	1	2	0.05	positive
Microlaena stipoides var. stipoides	2	1	2	0.11	positive
Opercularia diphylla	2	1	2	0.07	positive
Oplismenus aemulus	2	1	2	0.01	positive
Poranthera microphylla	2	1	2	0.07	positive
Pratia purpurascens	3	1	2	0.10	positive
Pteridium esculentum	4	1	2	0.40	positive
Senecio linearifolius	2	1	1	0.01	positive
Solanum prinophyllum	2	1	1	0.02	positive
Tylophora barbata	2	1	2	0.10	positive
Veronica plebeia	2	1	1	0.02	positive
Corymbia gummifera	0	0	2	0.52	negative
Entolasia stricta	0	0	2	0.53	negative

MU20 Cumberland Shale Hills Woodland

❑ *DESCRIPTION*

Cumberland Shale Hills Woodland (NPWS, 2000d) is dominated by *Eucalyptus moluccana* and *E. tereticornis* with *E. crebra* occurring less frequently. A small tree stratum is often present and most frequently includes *Acacia implexa* together with a variety of the commonly occurring Eucalypt species. It typically has a shrub stratum dominated by *Bursaria spinosa,* and more rarely includes other species such as *Acacia falcata*, *Breynia oblongifolia*, *Indigofera australis* and *Dodonaea viscosa* subsp. *cuneata*. The ground stratum is variable in cover. Often there is a good cover of grass and herb species, but this become quite sparse under a dense shrub stratum of *Bursaria spinosa* or the exotic species *Olea europaea* subsp. *cuspidata*. Ground cover species include *Dichondra repens*, *Brunoniella australis, Aristida ramosa*, *Desmodium varians*, *Microlaena stipoides* var. *stipoides*, *Themeda australis* and *Cheilanthes sieberi* subsp. *sieberi*.

Cumberland Shale Hills Woodland occurs almost exclusively on soils derived from Wianamatta Shales. It is closely related to Map Unit 21 Cumberland Shale Plains Woodlands. Generally, habitat can be used to distinguish the two communities. Map Unit 20 occurs on higher elevations and steeper slopes than Map Unit 21. Both form a component of Cumberland Plains Woodland, an Endangered Ecological Community listed under Part 3, Schedule 1 of the Threatened Species Conservation Act, 1995.

Within the catchments, this community occupies only small areas along the western boundary at the interface with shale soils. Most of the extant cover remains as highly fragmented and disturbed remnants forming an open cover of scattered trees between Bargo and Appin.

❑ *FLORISTIC SUMMARY*

Number of Sites: ***61***

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

Eucalyptus moluccana, Eucalyptus tereticornis, Eucalyptus crebra, and less frequently *Eucalyptus eugenioides, Eucalyptus amplifolia* subsp. *amplifolia, Angophora floribunda, Corymbia maculata, Angophora subvelutina, Eucalyptus fibrosa*

Shrubs: 2-5m tall. Mean Projected Canopy Cover 20%

Acacia implexa, Bursaria spinosa, Breynia oblongifolia, Acacia falcata, Indigofera australis

Ground covers: 0-0.5m tall. Mean Projected Canopy Cover 20%

Dichondra repens, Brunoniella australis, Aristida ramosa, Desmodium varians, Carex inversa, Asperula conferta, Dichelachne micrantha, Oxalis perennans, Cheilanthes sieberi subsp. *sieberi, Microlaena stipoides* var. *stipoides*

Vines and Twiners:

Glycine tabacina

❑ *KEY IDENTIFYING FEATURES*

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

- Open woodland dominated by Forest red gum (*Eucalyptus tereticornis*) and Grey box (*E. moluccana*). Generally located at higher elevations on steeper hillslopes.
- Understorey is generally open with a good cover of native grasses.
- Within the catchments, most remnants are highly disturbed and persist as paddock shade trees and roadside verges.

❑ *EXAMPLE LOCATIONS*

Cataract Road, near Appin

❑ *CONSERVATION STATUS*

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

BIOREGIONAL STATUS

Total Area within Sydney Basin Bioregion (ha)	Proportion of Bioregional Area within NPWS Reserve (%)	Area within Catchment (ha)	Proportion of Bioregional Area within Catchment (%)
4309	4.3	40.73	0.9

CONDITION ASSESSMENT

Disturbance Class	Area (ha)	Proportion Extant (%)
A Light	18.81	46.2
B Moderate	0	0
C Heavy	0	0
Scattered Trees	21.92	53.8
Total	40.73	100

❑ *THREATENED PLANT SPECIES*

None recorded

❑ *DIAGNOSTIC SPECIES*

(Diagnostic species relevant to Cumberland Plain sites; abundance Scores are 1-7)

Species Name	Group Score	Group Freq	Non Group Score	Non Group Freq	Fidelity Class
Alternanthera species A	1	0.02	0	0.00	positive
Aristida ramosa	3	0.84	2	0.17	positive
Asperula conferta	2	0.61	2	0.07	positive
Brunoniella australis	3	0.85	3	0.36	positive
Capillipedium spicigerum	1	0.03	0	0.00	positive
Carex inversa	2	0.62	2	0.07	positive
Chamaesyce dallachyana	1	0.02	0	0.00	positive
Chloris divaricata	1	0.02	0	0.00	positive
Cyperus fulvus	1	0.02	0	0.00	positive
Dactyloctenium radulans	1	0.02	0	0.00	positive
Desmodium varians	3	0.82	2	0.36	positive
Dichelachne micrantha	2	0.61	2	0.34	positive
Dichondra repens	3	0.97	3	0.50	positive
Eucalyptus moluccana	4	0.70	3	0.17	positive
Eucalyptus tereticornis	4	0.70	3	0.26	positive
Glycine tabacina	2	0.56	2	0.30	positive
Glycine tomentella	2	0.02	0	0.00	positive
Oxalis perennans	2	0.52	2	0.34	positive
Oxalis rubens	2	0.02	0	0.00	positive
Portulaca oleracea	1	0.03	0	0.00	positive
Veronica brownii	1	0.02	0	0.00	positive
Aristida vagans	2	0.23	2	0.52	negative
Entolasia stricta	4	0.02	3	0.58	negative
Lomandra multiflora subsp. multiflora	2	0.25	2	0.54	negative
Bursaria spinosa	4	0.92	3	0.53	constant
Cheilanthes sieberi subsp. sieberi	2	0.69	2	0.60	constant
Microlaena stipoides var. stipoides	3	0.79	3	0.76	constant
Themeda australis	4	0.77	3	0.60	constant

MU21 Cumberland Shale Plains Woodland

❑ *DESCRIPTION*

Cumberland Shale Plains Woodland (NPWS, 2000d) is dominated by *Eucalyptus moluccana* and *E. tereticornis* with *E. crebra*, *E. eugenioides* and *Corymbia maculata* occurring less frequently. These species often form a separate small tree stratum, occasionally including other species such as *Exocarpos cupressiformis*, *Acacia parramattensis* and *A. decurrens*. A shrub stratum is usually present and dominated by *Bursaria spinosa*. Common ground cover species include *Dichondra repens*, *Themeda australis*, *Desmodium varians*, *Microlaena stipoides* var. *stipoides*, *Brunoniella australis*, *Aristida vagans*, *Opercularia diphylla*, *Wahlenbergia gracilis* and *Dichelachne micrantha*.

Cumberland Shale Plains Woodland is the most widely distributed community on the Cumberland Plain. It predominantly occurs on soils derived from Wianamatta Shale, but also occurs on Holocene alluvium in well drained areas that are infrequently inundated. Isolated patches of this community may be found on soils derived from the Mittagong Formation, but only in the vicinity of outcrops of almost pure shale. Within the catchments this community is restricted to the extreme north western edge of the Metropolitan Catchment.

This community is closely related to Map Unit 20 (Cumberland Shale Hills Woodland). Both form a component of Cumberland Plains Woodland, an Endangered Ecological Community listed under Part 3, Schedule 1 of the Threatened Species Conservation Act, 1995.

❑ *FLORISTIC SUMMARY*

Number of Sites: ***72***

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

Eucalyptus moluccana, Eucalyptus tereticornis, Eucalyptus crebra and less frequently *Eucalyptus eugenioides, Eucalyptus amplifolia* subsp. *amplifolia, Angophora floribunda, Corymbia maculata, Angophora subvelutina, Eucalyptus fibrosa*

Shrubs: 2-5m tall. Mean Projected Canopy Cover 15%

Acacia decurrens, Acacia parramattensis, Exocarpos cupressiformis, Bursaria spinosa, Breynia oblongifolia

Ground covers: 0-0.5m tall. Mean Projected Canopy Cover 45%

Dichondra repens, Brunoniella australis, Aristida vagans, Desmodium varians, Themeda australis, Wahlenbergia gracilis, Microlaena stipoides var. *stipoides*

Vines and Twiners:

Glycine tabacina, Glycine clandestina

❑ *KEY IDENTIFYING FEATURES*

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

- Open woodland dominated by Forest red gum (*Eucalyptus tereticornis*) and Grey box (*E. moluccana*). Habitat characterised by undulating slopes and flats on Wianamatta Shale.
- Understorey is generally open with a good cover of native grasses.
- Within the Catchment, most remnants are highly disturbed and persist as paddock shade trees and roadside verges

❑ *EXAMPLE LOCATIONS*

Picton Road, near Wilton

❑ *CONSERVATION STATUS*

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

BIOREGIONAL STATUS

Total Area within Sydney Basin Bioregion (ha)	Proportion of Bioregional Area within NPWS Reserve (%)	Area within Catchment (ha)	Proportion of Bioregional Area within Catchment (%)
6745	8.4	112.38	1.7

CONDITION ASSESSMENT

Disturbance Class	Area (ha)	Proportion Extant (%)
A Light	2.59	2.3
B Moderate	71.44	63.6
C Heavy	38.35	34.1
Scattered Trees	0	0
Total	112.38	100

❑ *THREATENED PLANT SPECIES*

None recorded

❑ *DIAGNOSTIC SPECIES*

Species Name	Group Score	Group Freq	Non Group Score	Non Group Freq	Fidelity class
Acacia buxifolia	1	0.01	0	0.00	positive
Aristida ramosa	2	0.54	2	0.20	positive
Aristida vagans	3	0.92	2	0.42	positive
Arthropodium milleflorum	2	0.54	2	0.20	positive
Austrodanthonia setacea	2	0.01	0	0.00	positive

Species Name	Group Score	Group Freq	Non Group Score	Non Group Freq	Fidelity class
Austrodanthonia tenuior	2	0.51	2	0.16	positive
Brachycome multifida	4	0.01	0	0.00	positive
Brunoniella australis	3	0.88	3	0.35	positive
Calandrinia pickeringii	1	0.01	0	0.00	positive
Cymbopogon refractus	2	0.50	2	0.15	positive
Desmodium varians	3	0.86	2	0.34	positive
Dianella longifolia	2	0.60	1	0.17	positive
Dichelachne micrantha	3	0.75	2	0.31	positive
Dichondra repens	3	0.97	3	0.48	positive
Dichopogon strictus	1	0.04	0	0.00	positive
Dipodium punctatum	1	0.01	0	0.00	positive
Echinopogon caespitosus var. caespitosus	2	0.50	2	0.27	positive
Eragrostis leptostachya	2	0.69	2	0.22	positive
Eucalyptus moluccana	3	0.65	4	0.17	positive
Eucalyptus tereticornis	4	0.64	3	0.26	positive
Glycine clandestina	3	0.56	2	0.42	positive
Glycine tabacina	3	0.65	2	0.28	positive
Gnaphalium sphaericum	2	0.56	1	0.18	positive
Goodenia hederacea subsp. hederacea	2	0.56	2	0.32	positive
Lomandra filiformis subsp. filiformis	3	0.61	2	0.27	positive
Lomandra multiflora subsp. multiflora	2	0.57	2	0.50	positive
Opercularia diphylla	2	0.81	2	0.36	positive
Oxalis perennans	3	0.60	2	0.32	positive
Paspalidium distans	3	0.75	2	0.24	positive
Pimelea curviflora var. subglabrata	2	0.01	0	0.00	positive
Ranunculus lappaceus	3	0.03	0	0.00	positive
Rorippa laciniata	2	0.01	0	0.00	positive
Wahlenbergia gracilis	2	0.79	2	0.32	positive
Wurmbea biglandulosa	1	0.01	0	0.00	positive
Entolasia stricta	2	0.18	3	0.57	negative
Bursaria spinosa	4	0.97	3	0.52	constant
Cheilanthes sieberi subsp. sieberi	3	0.94	2	0.55	constant
Microlaena stipoides var. stipoides	4	0.90	3	0.74	constant
Themeda australis	4	0.88	3	0.58	constant

MU22 Transitional Shale Dry Ironbark Forest

❑ *DESCRIPTION*

Transitional Shale Dry Ironbark Forest occurs along the western edge of the Metropolitan Catchment. In this area, shale soils of the Cumberland Plain interface with the sandstone geologies of the Mittagong and Hawkesbury Formations. Remnant caps of shale soil also occur on top of the sandstone geologies at a number of disjunct locations in this area. The mix of both shale and sandstone soils produces a species composition that reflects the ecotone between the two environments. The ecotones vary in the degree of shale influence in the soil such that NPWS (2000d) identified two Transitional Shale-Sandstone Forests. This variation is highly localised in isolated shale cappings or gradual as distance from shale soil increases into sandstone geology along the western interface (NPWS, 2000d). No attempt has been made to map these two variations separately.

Ironbarks (*Eucalyptus crebra, E. fibrosa* and *E. paniculata* subsp. *paniculata*) and Stringybarks (*E. globoidea* and *E. eugenioides*) characterise the canopy species in this community, with *Eucalyptus punctata* a regular associate species. Other associated canopy species depend upon the thickness of the shale soil. At greater thickness, boxes (*Eucalyptus moluccana* and *E. bosistoana*) and Forest red gum (*E. tereticornis*) are more pronounced, while *Corymbia gummifera* marks the sandstone end of the gradient. The shrub stratum responds similarly to slight changes in soil fertility. *Bursaria spinosa* is the characteristic species of the small shrub layer in areas with greater shale influence. Scattered individuals of *Allocasuarina littoralis*, *Acacia irrorata* subsp. *irrorata* and *A. decurrens* are an occasional taller shrub stratum. In contrast, additional species such as *Kunzea ambigua*, *Persoonia linearis*, *Banksia ericifolia* subsp. *ericifolia* and *B. spinulosa* var. *spinulos*a are more common in the shrub layer where the sandstone influence is greater. The ground cover is distinctly grassy, supporting an amalgam of *Themeda australis*, *Entolasia stricta*, *E. marginata*, *Imperata cylindrica* var. *major* and *Echinopogon caespitosus* var. *caespitosus*. *Lepidosperma laterale*, *Lomandra longifolia*, *Pomax umbellata*, *Glycine clandestina* and *Hardenbergia violacea* also feature prominently.

Transitional Shale Dry Ironbark Forest forms a component of Shale Sandstone Transition Forest listed on Part 3 of Schedule 1 of the NSW Threatened Species Act (1995). Elsewhere, Benson & Howell (1994) refer to this community as Bargo Brush Forest, in response to early settler descriptions (cf. Atkinson, 1826, in Benson and Howell, 1994) of the vegetation in the Bargo area. The community is considerably more extensive than this area alone. Similar vegetation is present outside of the catchments, extending northwards into Holsworthy Military Area and Westwards near Picton and Camden.

❑ *FLORISTIC SUMMARY*

Number of Sites: 21

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

Eucalyptus crebra, Eucalyptus fibrosa, Eucalyptus paniculata subsp. *paniculata, Eucalyptus globoidea, Eucalyptus eugenioides, Eucalyptus punctata, Eucalyptus moluccana, Eucalyptus bosistoana, Eucalyptus tereticornis, Eucalyptus longifolia, Corymbia gummifera, Eucalyptus pilularis, Eucalyptus oblonga, Eucalyptus sparsifolia, Eucalyptus resinifera* subsp. *resinifera, Eucalyptus beyeriana, Angophora floribunda, Syncarpia glomulifera* subsp. *glomulifera*

Shrubs: 2-5m tall. Mean Projected Canopy Cover 25%

Allocasuarina littoralis, Acacia decurrens, Acacia mearnsii, Acacia irrorata subsp. *irrorata, Bursaria spinosa, Angophora bakeri, Daviesia ulicifolia, Kunzea ambigua, Persoonia linearis, Banksia ericifolia* subsp. *ericifolia, Banksia spinulosa* var. *spinulosa, Ricinocarpos pinifolia, Jacksonia scoparia, Dodonaea triquetra, Lissanthe strigosa*

Ground covers: 0.5-1 m tall. Mean Projected Canopy Cover 50%

Themeda australis, Aristida vagans, Entolasia stricta, Entolasia marginata, Aristida ramosa, Imperata cylindrica var. *major, Lepidosperma laterale, Echinopogon caespitosus* var. *caespitosus, Hardenbergia violacea, Lomandra longifolia, Lomandra glauca, Lomandra multiflora* subsp. *multiflora, Opercularia diphylla, Pomax umbellata*

❑ *KEY IDENTIFYING FEATURES*

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

- Ironbarks (*Eucalyptus fibrosa, E. paniculata* subsp. *paniculata* and *E. crebra*) are only found on shale influenced soils in the Metropolitan Catchment. The patches of shale soil tend to be small and discontinuous amongst an expanse of Exposed Sandstone Scribbly Gum Woodland. Ironbarks occur in combination with White stringybark (*E. globoidea*) and Grey gum (*E. punctata*). Sites may be dominated by Stringybark species with Ironbark species sparse or absent.
- Mainly located in the drier rainfall areas along the western edge of Nepean and Cataract Catchments where the vegetation cover meets the cleared land.
- Generally an open grassy understorey is present and is dominated by Kangaroo grass (*Themeda australis*), Blady grass (*Imperata cylindrica* var. *major*) and Spiny-headed mat-rush (*Lomandra longifolia*). A denser small shrub layer is often present where the shale influence diminishes. Some typical sandstone species are often found including *Banksia* spp. and Dogwood (*Jacksonia scoparia*).

❑ *EXAMPLE LOCATIONS*

Picton Road near Cascade Creek; Avon Dam Road near Freeway Junction

❑ *CONSERVATION STATUS*

Listed as an Endangered Ecological Community under Part 3 of Schedule 1 of the Threatened Species Conservation Act (1995) as part of Shale-Sandstone Transition Forest.

BIOREGIONAL STATUS

Total Area within Sydney Basin Bioregion (ha)	Proportion of Bioregional Area within NPWS Reserve (%)	Area within Catchment (ha)	Proportion of Bioregional Area within Catchment (%)
2766	0	1532.61	55.4

CONDITION ASSESSMENT

Disturbance Class	Area (ha)	Proportion Extant (%)
A Light	1086.96	70.9
B Moderate	198.83	13.0
C Heavy	42.85	2.8
Scattered Trees	203.97	13.3
Total	1532.61	100

❑ *THREATENED PLANT SPECIES*

Grevillea parviflora subsp. *parviflora* (V), *Epacris purpurascens* var. *purpurascens* (V)

❑ *DIAGNOSTIC SPECIES*

Species Name	Group Score	Group Freq	Non Group Score	Non Group Freq	Fidelity Class
Aristida ramosa	2	0.67	2	0.02	positive
Dodonaea triquetra	3	0.67	2	0.12	positive
Entolasia marginata	3	0.67	2	0.23	positive
Eucalyptus globoidea	2	0.67	3	0.12	positive
Eucalyptus paniculata subsp. paniculata	3	0.67	3	0.01	positive
Eucalyptus punctata	2	1.00	2	0.08	positive
Glycine clandestina	2	0.67	1	0.13	positive
Gompholobium species B	1	0.33	0	0.00	positive
Jacksonia scoparia	2	0.67	1	0.01	positive
Kunzea ambigua	3	1.00	1	0.06	positive
Lepidosperma laterale	2	0.67	1	0.32	positive
Lomandra filiformis subsp. coriacea	2	0.67	2	0.10	positive
Lomandra longifolia	2	0.67	2	0.43	positive
Phyllanthus hirtellus	2	0.67	2	0.22	positive
Pomax umbellata	2	1.00	1	0.11	positive
Themeda australis	2	0.67	2	0.08	positive
Corymbia gummifera	2	0.67	2	0.52	constant
Entolasia stricta	2	1.00	2	0.53	constant

MU23 Transitional Shale Stringybark Forest

❑ *DESCRIPTION*

Transitional Shale Stringybark Forest forms part of the Transitional Shale Sandstone Forest and Woodland Complex in dry environments along the western boundary of the catchments. It is a moderately tall forest of *Eucalyptus globoidea* and other closely associated stringybarks (*E. eugenioides and E. oblonga*). *Eucalyptus punctata* is a regular associate species along with a wide variety of other Eucalypts that mark the transition with greater shale influence (eg. *E. crebra* and *E. fibrosa*) to that of greater sandstone influence (*Corymbia gummifera, E. piperita* and *E. sclerophylla*). The understorey is similarly variable as a result of the changes in soil. Most commonly the ground cover is a combination of grasses such *as Entolasia stricta*, *E. marginata* and *Aristida ramosa* with *Lomandra longifolia* often present. A shrubby understorey species such as *Acacia terminalis, Banksia spinulosa* var. *spinulosa* and *Kunzea ambigua* are found in combination with taller species such as *Leptospermum polygalifolium* subsp. *polygalifolium*.

Transitional Shale Stringybark Forest is usually distributed on the margins of residual shale caps as the forest slowly grades into open sandstone woodlands. The forest is lower in height than the adjoining shale forest (eg. Map Unit 22) and consists of a less open understorey. Floristic composition may exhibit minor differences with slight changes in elevation and rainfall.

Transitional Shale Stringybark Forest forms a component of Shale Sandstone Transition Forest listed on Part 3 of Schedule 1 of the NSW Threatened Species Act (1995).

❑ *FLORISTIC SUMMARY*

Number of Sites: ***6***

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

Eucalyptus globoidea, Eucalyptus eugenioides, Eucalyptus punctata, Corymbia gummifera, Eucalyptus crebra, Eucalyptus piperita, Eucalyptus sclerophylla

Shrubs: 2-3m tall. Mean Projected Canopy Cover 25%

Banksia spinulosa var. *spinulosa, Persoonia linearis, Persoonia levis, Kunzea ambigua, Daviesia squarrosa*

Ground covers: 0.5-1 m tall. Mean Projected Canopy Cover 50%

Cyathochaeta diandra, Lomandra longifolia, Aristida vagans, Aristida ramosa, Entolasia stricta, Themeda australis, Joycea pallida

❑ *KEY IDENTIFYING FEATURES*

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

- Small areas of Stringybarks (*Eucalyptus eugenioides* and *E. globoidea*) dominant forest that mark the transition between sandstone woodlands (Map Unit 29 and 30) and other shale forests.
- A shrubby understorey that consists of a mix of Banksias, Tea-trees (*Leptospermum* spp.) and Geebungs (*Persoonia* spp.).
- Drier areas of the western catchments.

❑ *EXAMPLE LOCATIONS*

Fire Trail 8, Cataract Catchment; Intersection of 6B and 6, Avon Catchment, Old Hume Highway, Yerrinbool

❑ *CONSERVATION STATUS*

Listed as an Endangered Ecological Community under Part 3 of Schedule 1 of the Threatened Species Conservation Act (1995) as part of Shale-Sandstone Transition Forest.

BIOREGIONAL STATUS

Total Area within Sydney Basin Bioregion (ha)	Proportion of Bioregional Area within NPWS Reserve (%)	Area within Catchment (ha)	Proportion of Bioregional Area within Catchment (%)
8706	2.5	614.92	7.1

CONDITION ASSESSMENT

Disturbance Class	Area (ha)	Proportion Extant (%)
A Light	604.38	98.3
B Moderate	10.54	1.7
C Heavy	0	0
Scattered Trees	0	0
Total	614.92	100

❑ *THREATENED PLANT SPECIES*

Epacris purpurascens var. *purpurascens* (V)

❑ *DIAGNOSTIC SPECIES*

Species Name	Group Score	Group Freq	Non Group Score	Non Group Freq	Fidelity Class
Aristida ramosa	2	1.00	1	0.02	positive
Aristida vagans	2	0.83	1	0.04	positive
Arthropodium minus	1	0.17	0	0.00	positive
Austrostipa pubescens	2	0.50	2	0.15	positive
Banksia spinulosa var. spinulosa	2	0.50	2	0.45	positive
Brachycome angustifolia	2	0.67	2	0.02	positive
Brachyscome angustifolia	2	0.67	2	0.02	positive
Brunoniella pumilio	2	0.50	2	0.03	positive
Cyathochaeta diandra	2	0.67	2	0.32	positive
Daviesia genistifolia	1	0.17	0	0.00	positive
Daviesia squarrosa	3	0.33	0	0.00	positive
Desmodium varians	2	0.67	2	0.04	positive

Species Name	Group Score	Group Freq	Non Group Score	Non Group Freq	Fidelity Class
Dianella longifolia	2	1.00	2	0.06	positive
Dichondra repens	2	0.50	2	0.06	positive
Echinopogon caespitosus var. caespitosus	2	0.50	2	0.04	positive
Entolasia marginata	2	0.50	2	0.23	positive
Eucalyptus crebra	2	0.50	3	0.01	positive
Eucalyptus globoidea	3	0.67	2	0.11	positive
Glycine clandestina	2	0.83	1	0.12	positive
Gonocarpus tetragynus	2	1.00	2	0.14	positive
Goodenia hederacea subsp. hederacea	2	0.83	2	0.10	positive
Helichrysum scorpioides	2	0.50	1	0.03	positive
Hibbertia aspera subsp. aspera	2	0.50	2	0.13	positive
Hibbertia diffusa	2	0.67	2	0.01	positive
Hypericum gramineum	2	0.67	1	0.04	positive
Imperata cylindrica var. major	2	0.83	1	0.11	positive
Joycea pallida	3	0.67	2	0.03	positive
Lagenifera stipitata	2	0.67	2	0.09	positive
Lepidosperma gunnii	2	0.67	2	0.04	positive
Lepidosperma laterale	2	0.50	1	0.32	positive
Lissanthe strigosa	2	1.00	1	0.08	positive
Lomandra longifolia	2	0.50	2	0.43	positive
Lomandra multiflora subsp. multiflora	2	1.00	2	0.22	positive
Opercularia diphylla	2	1.00	2	0.06	positive
Persoonia linearis	2	0.50	2	0.23	positive
Phyllanthus hirtellus	2	0.83	2	0.22	positive
Plantago varia	2	0.17	0	0.00	positive
Poa sieberiana var. sieberiana	2	0.50	2	0.02	positive
Pratia purpurascens	2	0.50	2	0.10	positive
Themeda australis	3	0.67	2	0.08	positive
Corymbia gummifera	2	0.50	2	0.52	constant
Entolasia stricta	2	1.00	2	0.53	constant

MU24 Highlands Alluvial Red Gum Woodland

❑ *DESCRIPTION*

Highlands Alluvial Red Gum Woodland occurs on the poorly drained alluvial flats that surround Chain of Ponds Creek near Aylmerton in the Southern Highlands. The canopy is a low even cover of *Eucalyptus amplifolia* subsp. *amplifolia*, and includes very occasional *E. ovata and E viminalis* along creek banks. Much of the vegetation has been heavily cleared, with remnants still subject to heavy grazing pressures. Grasses are closely cropped by grazing, but do include *Poa labillardieri* var. *labillardieri*, *Microlaena stipoides* var. *stipoides* and *Aristida* spp. Shrubs are virtually absent, although occasional *Melaleuca linariifolia* occur in isolated patches.

This community has not been well sampled, with the majority of the distribution occurring on private land. Highlands Alluvial Red Gum Woodland forms a component of Southern Highlands Shale Woodlands listed on Part 3 of Schedule 1 of the NSW Threatened Species Act (1995). Limited information is available on similar communities on the Southern Highlands. NPWS (2000a) describe an alluvial community characterised by *E. amplifolia* subsp. *amplifolia* and *E. mannifera* subsp*. mannifera* (Forest Ecosystem 194). This Ecosystem has not been sampled and comparisons with Highlands Alluvial Red Gum Woodland remain a future endeavour.

❑ *FLORISTIC SUMMARY*

Number of Sites: ***No samples***

Trees: 12-25m tall. Mean Projected Canopy Cover 25%

Eucalyptus amplifolia subsp. *amplifolia, Eucalyptus ovata, Eucalyptus viminalis, Eucalyptus mannifera* subsp. *mannifera*

Shrubs: 2-3m tall. Mean Projected Canopy Cover 1%

Melaleuca linariifolia

Ground covers: 0.5-1 m tall. Mean Projected Canopy Cover 50%

Poa labillardieri var. *labillardieri, Lomandra longifolia, Microlaena stipoides* var. *stipoides*

❑ *KEY IDENTIFYING FEATURES*

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

- Heavily disturbed and fragmented remnants on alluvial soils.
- An open grassy understorey.
- A canopy dominated by Cabbage gum (*Eucalyptus amplifolia* subsp. *amplifolia*).

❑ *EXAMPLE LOCATIONS*

Old South Road, between Alpine and the Mittagong landing ground.

❑ *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.

BIOREGIONAL STATUS

Total Area within Sydney Basin Bioregion (ha)	Proportion of Bioregional Area within NPWS Reserve (%)	Area within Catchment (ha)	Proportion of Bioregional Area within Catchment (%)
2140	0	92.62	4.3

CONDITION ASSESSMENT

Disturbance Class	Area (ha)	Proportion Extant (%)
A Light	10.31	11.1
B Moderate	21.07	22.7
C Heavy	6.93	7.5
Scattered Trees	54.31	58.6
Total	92.62	100

❑ *THREATENED PLANT SPECIES*

None recorded

❑ *DIAGNOSTIC SPECIES*

No Diagnostic Species List available as no survey sites were undertaken in this community.

MU25 Sandstone Gully Apple-Peppermint Forest

❑ *DESCRIPTION*

Sandstone Gully Apple-Peppermint Forest occurs on sheltered slopes and gullies on the Hawkesbury Sandstones of the northern Woronora Plateau. *Angophora costata* and *Eucalyptus piperita* dominate the canopy with *Corymbia gummifera* and *E. sieberi* occurring less frequently 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*.

A number of floristic variations occur within this Map Unit in response to changes in the moisture gradient. The stream banks and gully lines are marked by the occurrence of moisture loving species such as *Bauera rubioides*, *Gleichenia dicarpa* and *Grevillea longifolia*. These species are generally not far from stream banks and as such comprise a distinct assemblage, although such variation is too small to map at this scale. Elsewhere, in other less incised gullies, the understorey can comprise a dense cover of the fern *Calochlaena dubia*.

Sandstone Gully Apple-Peppermint Forest has been previously described and mapped by Keith (1994) as Eastern Gully Forest and (NPWS 2000c) as Eastern Sandstone Gully Forest. While limited to the northern section of the Study Area, this community extends 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 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*

BIOREGIONAL STATUS

Total Area within Sydney Basin Bioregion (ha)	Proportion of Bioregional Area within NPWS Reserve (%)	Area within Catchment (ha)	Proportion of Bioregional Area within Catchment (%)
11868	82	3962.95	33.4

CONDITION ASSESSMENT

Disturbance Class	Area (ha)	Proportion Extant (%)
A Light	3936.79	99.3
B Moderate	7.23	0.2
C Heavy	0	0
Scattered trees	18.93	0.5
Total	3962.95	100

❑ *THREATENED PLANT SPECIES*

Leucopogon exolasius (V), *Grevillea longifolia* (2RC-), *Lomandra fluviatilis* (3RCa)

❑ *DIAGNOSTIC SPECIES*

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
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

MU26 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 obliqua*, *L. longifolia*, *L. filiformis, Patersonia glabrata*, *Dianella caerulea*, *Billardiera scandens*, *Gonocarpus teucrioides*, *Lomatia silaifolia* and *Phyllanthus hirtellus* found consistently within sites. Variation occurs within this Map Unit in response to degree of shelter and rainfall. Near the escarpment edge this community is found on ridgetops particularly near the convergence of Hawkesbury and Narrabeen Sandstones. In drier locations, in shallow gullies and upper slopes the composition of this community can resemble that found within sandstone ridgetop woodlands.

This forest is very closely related to Map Unit 25 Sandstone Gully Apple-Peppermint Forest. The immediate difference is the absence of *Angophora costata* and *Doryanthes excelsa*. Sheltered Hawkesbury 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*

Widespread on Sandstone in Avon, Cordeaux and Cataract Catchments

❑ *CONSERVATION STATUS*

BIOREGIONAL STATUS

Total Area within Sydney Basin Bioregion (ha)	Proportion of Bioregional Area within NPWS Reserve (%)	Area within Catchment (ha)	Proportion of Bioregional Area within Catchment (%)
24500	38	9994.77	40.8

CONDITION ASSESSMENT

Disturbance Class	Area (ha)	Proportion Extant (%)
A Light	9993.06	100.0
B Moderate	1.07	0.0
C Heavy	0	0
Scattered trees	0.64	0.0
Total	9994.77	100

❑ *THREATENED PLANT SPECIES*

Pultenaea aristata (V), *Darwinia grandiflora* (2RCi), *Hibbertia nitida* (2RC-)

❑ *DIAGNOSTIC SPECIES*

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

Species Name	Group Score	Group Freq	Non Group Score	Non Group Freq	Fidelity class
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
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

MU27 Nepean Sandstone Gully Forest

❑ *DESCRIPTION*

In the south west of the Study Area another form of sandstone forest characterises the more open gullies and slopes. The Nepean Sandstone Gully Forest features *Corymbia gummifera*, *Eucalyptus piperita*, *E. punctata* and *E. agglomerata* as the prominent canopy species. The shrub layer is moderately dense, typified by a mix of small trees and shrubs. On lower, more protected slopes typical species include *Allocasuarina torulosa, Persoonia linearis*, *Elaeocarpus reticulatus*, *Leucopogon lanceolatus* var. *lanceolatus, Xylomelum pyriforme* and *Ceratopetalum gummiferum*. The ground cover is frequently comprises *Lomatia silaifolia*, *Pteridium esculentum*, *Entolasia stricta* and *Lepidosperma laterale*. *Banksia serrata* and *B. spinulosa* var. *spinulosa* are found in drier locations associated with upper slopes and exposed aspects. Rocky outcrops, chutes and benches are common.

Nepean Sandstone Gully Forest is mainly found within the Nepean and Avon Catchments. It is also found further west at similar elevations throughout the Nattai Plateau of the Warragamba Special Area (Map Unit 11: Sheltered Sandstone Blue-leaved Stringybark Forest (NPWS, 2003)).

❑ *FLORISTIC SUMMARY*

Number of Sites: 6

Trees: 6-10m tall. Mean Projected Canopy Cover 10%

Corymbia gummifera, Eucalyptus punctata, Eucalyptus piperita, Eucalyptus agglomerata, Eucalyptus globoidea, Eucalyptus oblonga, Eucalyptus sieberi

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

Allocasuarina torulosa, Elaeocarpus reticulatus, Leucopogon lanceolatus var. *lanceolatus, Banksia spinulosa* var. *spinulosa, Persoonia linearis, Persoonia levis, Ceratopetalum gummiferum, Astrotricha latifolia, Banksia ericifolia* subsp. *ericifolia*

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

Pteridium esculentum, Entolasia stricta, Dianella caerulea, Lepidosperma laterale, Lomatia silaifolia, Blechnum cartilagineum

❑ *KEY IDENTIFYING FEATURES*

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

- Slopes and open gullies on sandstone in the south-west of the Metropolitan Catchment.
- Open forest dominated by Grey gum (*Eucalyptus punctata*).
- Stands of Forest oak (*Allocasuarina torulosa*) in the small tree layer. A diverse shrub layer that includes Banksias (*B. spinulosa* var. *spinulosa*), Geebungs (*Persoonia linearis* and *P. levis*) and Blueberry ash (*Elaeocarpus reticulatus*).

❑ *EXAMPLE LOCATIONS*

Minor gullies off the Nepean River, below Fire Trail 3a and Fire Trail No 2.

❑ *CONSERVATION STATUS*

BIOREGIONAL STATUS

Total Area within Sydney Basin Bioregion (ha)	Proportion of Bioregional Area within NPWS Reserve (%)	Area within Catchment (ha)	Proportion of Bioregional Area within Catchment (%)
>15000	53	7321.25	48.8

CONDITION ASSESSMENT

Disturbance Class	Area (ha)	Proportion Extant (%)
A Light	7297.05	99.7
B Moderate	17.18	0.2
C Heavy	0	0
Scattered trees	7.01	0.1
Total	7321.25	100

❑ *THREATENED PLANT SPECIES*

Hibbertia nitida (2RC-), *Lissanthe sapida* (3RCa)

❑ *DIAGNOSTIC SPECIES*

Species Name	Group Score	Group Freq	Non Group Score	Non Group Freq	Fidelity Class
Astrotricha latifolia	2	0.62	2	0.08	positive
Banksia spinulosa var. spinulosa	2	0.50	2	0.21	positive
Blechnum cartilagineum	3	0.58	3	0.10	positive
Clematis aristata	2	0.69	2	0.34	positive
Corymbia gummifera	4	0.81	4	0.11	positive
Dampiera purpurea	2	0.62	2	0.16	positive
Dianella caerulea	2	0.73	2	0.34	positive
Elaeocarpus reticulatus	2	0.77	1	0.15	positive
Entolasia stricta	2	0.77	2	0.35	positive
Eucalyptus agglomerata	4	0.62	4	0.13	positive
Eucalyptus piperita	4	0.65	4	0.14	positive
Eucalyptus punctata	2	0.77	3	0.33	positive
Gonocarpus teucrioides	3	0.77	2	0.15	positive
Lepidosperma laterale	2	0.62	2	0.25	positive

Species Name	Group Score	Group Freq	Non Group Score	Non Group Freq	Fidelity Class
Leucopogon lanceolatus var. lanceolatus	2	0.62	2	0.27	positive
Lomatia silaifolia	2	0.88	2	0.24	positive
Pandorea pandorana subsp. pandorana	2	0.50	2	0.25	positive
Phyllanthus hirtellus	2	0.85	2	0.27	positive
Pteridium esculentum	3	0.77	2	0.35	positive
Smilax glyciphylla	2	0.54	1	0.07	positive
Xylomelum pyriforme	2	0.62	2	0.06	positive
Billardiera scandens var. scandens	1	0.77	1	0.32	uninformative

MU28 Western Sandstone Gully Forest

❑ *DESCRIPTION*

Western Sandstone Gully Forest (NPWS, 2000c) is dominated by *Angophora costata*, *Corymbia gummifera* and *Eucalyptus pilularis*, with *E. punctata* occurring sporadically on mid-slopes. A sparse layer of smaller trees is usually present, and dominated by *Allocasuarina littoralis* and *Ceratopetalum gummiferum*. The shrub and ground strata are also sparse and often contain slightly fewer species relative to ridgetop communities. Shrub species include *Leptospermum trinervium*, *Persoonia linearis, Acacia terminalis* and *Banksia spinulosa* var. *spinulosa*. In the ground stratum, the fern species *Pteridium esculentum* is invariably present, along with the climber *Smilax glyciphylla*. Other species frequently recorded in the ground stratum include *Entolasia stricta*, *Dianella caerulea*, *Gonocarpus teucrioides, Lomandra longifolia*, *L. obliqua*, *L. gracilis* and *Lepidosperma laterale*.

Western Sandstone Gully Forest occurs on the lower slopes of sandstone gullies on the western side of the Woronora Plateau where annual rainfall falls below approximately 1050 millimetres. The gradation into Sandstone Ridgetop woodland generally occurs less than half way up the slope from the gully floor. In particularly sheltered gullies, mesic species such as *Backhousia myrtifolia and Pittosporum undulatum* form a dense small tree stratum. Vines such as *Cissus hypoglauca* may also be locally abundant, and dense patches of fern, such as *Calochlaena dubia,* also occur. Beyond the Catchments, Western Sandstone Gully Forest extends north into the Holsworthy Military Area (French *et al.*, 2000).

❑ *FLORISTIC SUMMARY*

Number of Sites: 18

Trees: 20-25 m tall. Mean Projected Canopy Cover 18%

Eucalyptus pilularis, Eucalyptus punctata, Angophora costata, Corymbia gummifera, Eucalyptus piperita, Eucalyptus agglomerata, Angophora floribunda

Small Trees: 7-10m tall. Mean Projected Canopy Cover 12%

Angophora bakeri, Ceratopetalum gummiferum, Allocasuarina littoralis

Shrubs: 1-3m tall. Mean Projected Canopy Cover 20%

Acacia terminalis, Leptospermum trinervium, Persoonia linearis, Xanthosia pilosa, Banksia spinulosa var. *spinulosa*

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

Pteridium esculentum, Entolasia stricta, Dianella caerulea, Lepidosperma laterale, Lomandra obliqua

❑ *KEY IDENTIFYING FEATURES*

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

- Tall forest of Blackbutt (*Eucalyptus pilularis*), Grey gum (*E. punctata*) and Smooth-barked apple (*Angophora costata*).
- Steep slopes of deeply dissected sandstone gorges in north western Cataract and O'Hares Catchments.
- A relatively open understorey with small trees of Black sheoak (*Allocasuarina littoralis*), Narrow-leaved apple (*Angophora bakeri*) with a mix of Wattles, Geebungs and Tea-tree species.
- A ground cover of Bracken (*Pteridium esculentum*) and grasses such as Wiry Panic (*Entolasia stricta*).

❑ *EXAMPLE LOCATIONS*

Broughton Pass, Cataract River; Lysaghts Road Crossing, Georges River, Appin; Cascade Creek, Wilton

❑ *CONSERVATION STATUS*

BIOREGIONAL STATUS

Total Area within Sydney Basin Bioregion (ha)	Proportion of Bioregional Area within NPWS Reserve (%)	Area within Catchment (ha)	Proportion of Bioregional Area within Catchment (%)
7873	6.8	621.21	7.9

CONDITION ASSESSMENT

Disturbance Class	Area (ha)	Proportion Extant (%)
A Light	613.18	98.7
B Moderate	8.03	1.3
C Heavy	0	0
Scattered trees	0	0
Total	621.21	100

❑ *THREATENED PLANT SPECIES*

Grevillea parviflora subsp. *parviflora* (V), *G. longifolia* (2RC-)

❑ *DIAGNOSTIC SPECIES*

Species Name	Group Score	Group Freq	Non Group Score	Non Group Freq	Fidelity Class
Acacia terminalis	2	0.92	2	0.12	positive
Allocasuarina littoralis	2	0.61	2	0.23	positive
Angophora costata	4	0.81	2	0.07	positive
Banksia integrifolia var. integrifolia	1	0.03	0	0.00	positive
Banksia spinulosa var. spinulosa	2	0.58	2	0.16	positive
Cassinia longifolia	2	0.11	0	0.00	positive
Corymbia gummifera	2	0.78	3	0.18	positive
Ceratopetalum gummiferum	2	0.75	1	0.02	positive
Crowea saligna	1	0.03	0	0.00	positive

Species Name	Group Score	Group Freq	Non Group Score	Non Group Freq	Fidelity Class
Dianella caerulea	2	0.89	1	0.16	positive
Dianella revoluta var. revoluta	2	0.61	2	0.34	positive
Doryanthes excelsa	2	0.08	0	0.00	positive
Entolasia stricta	3	0.94	3	0.48	positive
Epacris longiflora	3	0.06	0	0.00	positive
Eucalyptus pilularis	4	0.69	4	0.07	positive
Gonocarpus teucrioides	2	0.64	2	0.04	positive
Hibbertia cistiflora	2	0.03	0	0.00	positive
Hovea purpurea	1	0.03	0	0.00	positive
Lepidosperma laterale	2	0.69	2	0.40	positive
Leptospermum trinervium	2	0.86	2	0.18	positive
Lepidosperma viscidum	1	0.08	0	0.00	positive
Leucopogon amplexicaulis	4	0.03	0	0.00	positive
Liparis reflexa	3	0.03	0	0.00	positive
Lomandra cylindrica	2	0.50	2	0.11	positive
Lomandra gracilis	2	0.67	2	0.07	positive
Lomandra longifolia	2	0.72	2	0.26	positive
Lomandra obliqua	2	0.83	2	0.19	positive
Olearia tomentosa	1	0.03	0	0.00	positive
Persoonia linearis	2	0.83	2	0.28	positive
Phyllanthus hirtellus	2	0.64	2	0.25	positive
Platysace linearifolia	2	0.61	2	0.05	positive
Podocarpus spinulosus	2	0.11	0	0.00	positive
Pomax umbellata	2	0.50	2	0.33	positive
Psilotum nudum	2	0.03	0	0.00	positive
Pteridium esculentum	3	0.97	2	0.07	positive
Pterostylis nutans	2	0.03	0	0.00	positive
Senecio bipinnatisectus	2	0.03	0	0.00	positive
Xanthosia pilosa	2	0.89	2	0.06	positive
Zieria pilosa	1	0.11	0	0.00	positive

MU29 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 occasionally 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* and *Entolasia stricta*, and small shrubs including *Dampiera stricta* and tangles of *Caustis flexuosa* frequently encountered.

This vegetation community occurs on skeletal sandy soils of low fertility. 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 (1994) as Exposed Sandstone Woodland, by Keith (1994) as Sandstone Woodland and by NPWS (2000c) as Sandstone Ridgetop Woodland. Site data described in Section 4.1.6 of this report highlighted variations within this community. These are likely to be responses to gradual changes in rainfall, elevation and fire history.

❑ *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 (*E. 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*

BIOREGIONAL STATUS

Total Area within Sydney Basin Bioregion (ha)	Proportion of Bioregional Area within NPWS Reserve (%)	Area within Catchment (ha)	Proportion of Bioregional Area within Catchment (%)
37022	9	35964.20	97.1

CONDITION ASSESSMENT

Disturbance Class	Area (ha)	Proportion Extant (%)
A Light	35644.33	99.1
B Moderate	185.71	0.5
C Heavy	18.35	0.1
Scattered trees	115.81	0.3
Total	36172.08	100

❑ *THREATENED PLANT SPECIES*

Epacris purpurascens var. *purpurascens* (V), *Leucopogon exolasius* (V), *Pultenaea aristata* (V), *Darwinia grandiflora* (2RCi), *Eucalyptus apiculata* (3RC-), *E. luehmanniana* (2RCa), *Grevillea longifolia* (2RC-), *Hibbertia nitida* (2RC-)

❑ *DIAGNOSTIC SPECIES*

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
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

MU30 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 and 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 within the catchments, 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 were located at mean elevation of 515 metres above sea level.

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 woodlands found on soils of Hawkesbury Sandstone. The distribution of this community outside of the Special Areas is poorly known.

❑ *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*

BIOREGIONAL STATUS

Total Area within Sydney Basin Bioregion (ha)	Proportion of Bioregional Area within NPWS Reserve (%)	Area within Catchment (ha)	Proportion of Bioregional Area within Catchment (%)
>5503	0	5503.27	100

CONDITION ASSESSMENT

Disturbance Class	Area (ha)	Proportion Extant (%)
A Light	5499.97	99.9
B Moderate	0	0
C Heavy	0	0
Scattered trees	3.29	0.1
Total	5503.27	100

❑ *THREATENED PLANT SPECIES*

Hibbertia nitida (2RC-), *Lissanthe sapida* (3RCa)

❑ *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

MU31 Highlands Sandstone Scribbly Gum Woodland

❑ *DESCRIPTION*

The cooler climates associated with the higher elevations of the southern Nepean Catchment brings a variation to other exposed sandstone woodlands found across the Woronora Plateau. Highlands Sandstone Scribbly Gum Woodland is typified by a low open canopy of even height (ten to fifteen metres) that is dominated by *Eucalyptus sclerophylla/racemosa*. Other canopy species include *Eucalyptus globoidea/oblonga* and *Corymbia gummifera* with *E. mannifera* subsp. *mannifera* and *E. radiata* subsp. *radiata* in shallow frost hollows. Generally, the low shrub layer is comprised of *Banksia spinulosa* var. *spinulosa*, *Allocasuarina paludosa*, *B. oblongifolia*, *Isopogon anemonifolius* and *Hakea dactyloides*. Ground cover is also diverse with *Dampiera stricta*, *Goodenia bellidifolia* subsp. *bellidifolia*, *Lindsaea linearis*, *Cyathochaeta diandra* and *Mitrasacme polymorpha*. A number of sites include a very grassy understorey of *Poa sieberiana* var. *sieberiana* and *Joycea pallida*. Benson & Howell (1994) suggest that at these sites the shallow, sandy soil is subject to periodic inundation.

Highlands Sandstone Scribbly Gum Woodland is situated on sandstones above 550 metres in elevation. It is widespread south of the catchment across the Morton-Budawang plateau. The equivalent vegetation community in the south coast region has been defined as Forest Ecosystem 139: Northern Coastal Hinterland Heath Shrub Dry Forest (NPWS, 2000a).

❑ *FLORISTIC SUMMARY*

Number of Sites: ***5***

Trees: 15m tall. Mean Projected Canopy Cover 25%

Eucalyptus sclerophylla/racemosa, Eucalyptus globoidea, Eucalyptus sieberi, Eucalyptus mannifera subsp. *mannifera, Eucalyptus rossii, Eucalyptus radiata* subsp. *radiata, Corymbia gummifera*

Shrubs: 1-3m tall. Mean Projected Shrub Cover 20%

Banksia spinulosa var. *spinulosa, Banksia oblongifolia, Isopogon anemonifolius, Hakea dactyloides, Allocasuarina paludosa, Petrophile pedunculata, Pultenaea elliptica, Grevillea sericea*

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

Dampiera stricta, Austrostipa pubescens, Entolasia stricta, Lepyrodia scariosa, Cyathochaeta diandra, Joycea pallida, Poa labillardieri var. *labillardieri, Goodenia bellidifolia* subsp. *bellidifolia, Lindsaea linearis, Mitrasacme polymorpha*

❑ *KEY IDENTIFYING FEATURES*

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

- A low open woodland dominated by Scribbly gum (*E. sclerophylla/racemosa/rossii*).
- Sandstone derived soils above 550 metres in elevation.
- A low relatively open shrub layer of typical sandstone heath species such as Banksias, Hakeas and Tea-trees.
- A ground cover that is sometimes a prominent cover of Snowgrass (*Poa sieberiana* var. *sieberiana*) or Silvertop wallaby grass (*Joycea pallida*).

❑ *EXAMPLE LOCATIONS*

Fire Trails 2 and 3, Nepean Catchment.

❑ *CONSERVATION STATUS*

BIOREGIONAL STATUS

Total Area within Sydney Basin Bioregion (ha)	Proportion of Bioregional Area within NPWS Reserve (%)	Area within Catchment (ha)	Proportion of Bioregional Area within Catchment (%)
48899	32	951.12	1.9

CONDITION ASSESSMENT

Disturbance Class	Area (ha)	Proportion Extant (%)
A Light	894.99	94.1
B Moderate	22.75	2.4
C Heavy	17.75	1.9
Scattered trees	15.63	1.6
Total	951.12	100

❑ *THREATENED PLANT SPECIES*

None recorded

❑ *DIAGNOSTIC SPECIES*

Species Name	Group Score	Group Freq	Non Group Score	Non Group Freq	Fidelity Class
Allocasuarina paludosa	3	0.80	1	0.01	positive
Austrostipa pubescens	2	1.00	2	0.14	positive
Banksia oblongifolia	2	0.80	2	0.22	positive
Banksia spinulosa var. spinulosa	3	1.00	2	0.45	positive
Cyathochaeta diandra	2	1.00	2	0.32	positive
Dampiera stricta	2	1.00	2	0.36	positive
Eucalyptus racemosa	2	1.00	2	0.29	positive
Gonocarpus tetragynus	2	1.00	2	0.14	positive
Goodenia bellidifolia subsp. bellidifolia	2	1.00	2	0.14	positive
Grevillea sericea	2	0.60	2	0.09	positive
Hakea dactyloides	3	1.00	2	0.38	positive
Hibbertia serpyllifolia	2	1.00	1	0.05	positive
Hypericum gramineum	2	0.80	1	0.04	positive
Isopogon anemonifolius	2	0.80	2	0.40	positive
Lepyrodia scariosa	2	0.80	2	0.33	positive
Lindsaea linearis	2	1.00	2	0.25	positive
Lomandra multiflora subsp. multiflora	2	0.60	2	0.22	positive
Mitrasacme polymorpha	2	1.00	2	0.15	positive
Poa labillardierei var. labillardierei	2	0.60	2	0.04	positive
Pultenaea elliptica	2	1.00	2	0.19	positive
Corymbia gummifera	0	0.00	2	0.52	negative
Entolasia stricta	2	1.00	2	0.53	constant

MU32 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*

BIOREGIONAL STATUS

Total Area within Sydney Basin Bioregion (ha)	Proportion of Bioregional Area within NPWS Reserve (%)	Area within Catchment (ha)	Proportion of Bioregional Area within Catchment (%)
14953	60	488.51	3.3

CONDITION ASSESSMENT

Disturbance Class	Area (ha)	Proportion Extant (%)
A Light	482.19	98.7
B Moderate	1.80	0.4
C Heavy	4.51	0.9
Scattered trees	0	0
Total	488.51	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	0.33	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
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

MU33 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 (Map Unit 29) or where soil is skeletal. The ground cover provides one of 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 (MU17).

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

❑ *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*

BIOREGIONAL STATUS

Total Area within Sydney Basin Bioregion (ha)	Proportion of Bioregional Area within NPWS Reserve (%)	Area within Catchment (ha)	Proportion of Bioregional Area within Catchment (%)
1453	68	601.87	41.1

CONDITION ASSESSMENT

Disturbance Class	Area (ha)	Proportion Extant (%)
A Light	560.09	93.1
B Moderate	16.55	2.7
C Heavy	2.85	0.5
Scattered trees	22.38	3.7
Total	601.87	100

❑ *THREATENED PLANT SPECIES*

Pultenaea aristata (V), *Darwinia grandiflora* (2RCi), *Hibbertia nitida* (2RC-)

❑ *DIAGNOSTIC SPECIES*

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

MU34 Sandstone Heath-Woodland

❑ *DESCRIPTION*

In the O'Hares and Woronora Catchments there are several broad flat plateaux that are characterised by a very low open woodland and heath complex. Sandstone Heath-Woodland (Keith, 1994) forms a combination of communities that are aligned by a ironstone substrate that have been separated for descriptive purposes using vegetation structure.

Sandstone Heath-Woodland features *Eucalyptus haemastoma/racemosa*, *E. sieberi*, *Corymbia gummifera* and *E. oblonga*. Occasional clumps of mallee *Eucalyptus luehmanniana* are present in small isolated patches. The trees barely reach ten metres in height and are generally very widely spaced. The shrub layer comprises a diverse cover of *Petrophile pulchella*, *Banksia ericifolia* subsp. *ericifolia*, *B. oblongifolia*, *Persoonia pinifolia*, *Hakea dactyloides*, *Pimelea linifolia* subsp. *linifolia*, *Lambertia formosa* and *Leptospermum trinervium*. The ground cover is similarly variable with *Patersonia glabrata*, *Cyathochaeta diandra*, *Lepyrodia scariosa*, *Leptocarpus tenax* and *Dampiera stricta* common examples. The soil is a shallow and well drained sandy loam. The colouration of the soil does appear to be variable with *Eucalyptus haemastoma* clearly dominant on the bleached white sands and the yellow-orange ochre sands providing more suitable conditions for stunted *E. sieberi* and *E. oblonga*. A thin mantle of heavily fragmented ironstone is regularly observed amongst the ground cover.

Outside of the Special Areas this community extends into Royal National Park, Heathcote National Park and Holsworthy Military Area

❑ *FLORISTIC SUMMARY*

Number of Sites: 19

Trees: 6-10m tall. Mean Projected Canopy Cover 10%

Eucalyptus haemastoma/racemosa, Eucalyptus sieberi, Eucalyptus oblonga, Corymbia gummifera (occasional *Eucalyptus luehmanniana*)

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

Banksia ericifolia subsp. *ericifolia, Petrophile pulchella, Grevillea oleoides, Banksia oblongifolia, Persoonia, pinifolia, Hakea dactyloides, Pimelea linifolia subsp. linifolia, Lambertia formosa, Leptospermum trinervium, Banksia serrata*

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

Dampiera stricta, Patersonia glabrata, Cyathochaeta diandra, Lepyrodia scariosa, Leptocarpus tenax

❑ *KEY IDENTIFYING FEATURES*

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

- Low and very open woodland dominated by Scribbly gums (*Eucalyptus haemastoma/racemosa*), and sometimes with Silvertop ash (*E. sieberi*), Stringybark (*E. oblonga*) and Red bloodwood (*Corymbia gummifera*) with occasional mallee Yellow-top ash (*E. luehmanniana*).
- A diverse and thick shrub layer that includes Banksias (*B. ericifolia* subsp. *ericifolia, B. paludosa* subsp. *paludosa*), Tea-tree (*Leptospermum trinervium*), *Grevillea oleoides*, *Hakea dactyloides*, Conesticks (*Petrophile pulchella*) and Broadleaf drumsticks (*Isopogon anemonifolius*).
- Shallow sandy soil often bleached white or at other times a yellow-orange ochre, on broad flat plateaux in Woronora and O'Hares Catchments

❑ *EXAMPLE LOCATIONS*

10B Fire Trail O'Hares Catchment; Extensive on Fire Trails 9E and 9 in Woronora Catchment.

❑ *CONSERVATION STATUS*

BIOREGIONAL STATUS

Total Area within Sydney Basin Bioregion (ha)	Proportion of Bioregional Area within NPWS Reserve (%)	Area within Catchment (ha)	Proportion of Bioregional Area within Catchment (%)
>500	44	408.09	81.6

CONDITION ASSESSMENT

Disturbance Class	Area (ha)	Proportion Extant (%)
A Light	408.09	100
B Moderate	0	0
C Heavy	0	0
Scattered trees	0	0
Total	408.09	100

❑ *THREATENED PLANT SPECIES*

Eucalyptus luehmanniana (2RCa)

❑ *DIAGNOSTIC SPECIES*

Species Name	Group Score	Group Freq	Non Group Score	Non Group Freq	Fidelity Class
Acacia suaveolens	2	0.74	1	0.31	positive
Actinotus minor	2	1.00	2	0.28	positive
Anisopogon avenaceus	2	0.58	2	0.12	positive
Banksia ericifolia subsp. ericifolia	3	0.95	2	0.33	positive

Species Name	Group Score	Group Freq	Non Group Score	Non Group Freq	Fidelity Class
Banksia oblongifolia	3	0.74	2	0.21	positive
Banksia serrata	2	0.74	2	0.36	positive
Bossiaea ensata	2	0.58	1	0.13	positive
Callistemon rigidus	1	0.05	0	0.00	positive
Cyathochaeta diandra	2	0.53	2	0.32	positive
Dampiera stricta	2	0.95	2	0.34	positive
Epacris microphylla var. microphylla	2	1.00	2	0.18	positive
Eucalyptus luehmanniana	3	0.53	3	0.02	positive
Eucalyptus racemosa	3	0.74	2	0.28	positive
Glossodia minor	1	0.05	0	0.00	positive
Goodenia stelligera	1	0.05	0	0.00	positive
Grevillea oleoides	2	0.95	2	0.22	positive
Grevillea sphacelata	2	0.53	1	0.15	positive
Hakea dactyloides	2	0.89	2	0.37	positive
Hakea teretifolia	2	0.89	2	0.21	positive
Isopogon anemonifolius	2	0.89	2	0.39	positive
Lambertia formosa	2	0.74	2	0.36	positive
Leptocarpus tenax	2	0.58	2	0.12	positive
Leptospermum arachnoides	2	0.84	1	0.16	positive
Leptospermum polygalifolium	2	0.63	2	0.09	positive
Lepyrodia scariosa	2	0.89	2	0.32	positive
Leucopogon esquamatus	2	0.79	1	0.06	positive
Lomandra obliqua	2	0.74	2	0.44	positive
Petrophile pulchella	2	0.95	2	0.28	positive
Platysace linearifolia	2	0.79	2	0.38	positive
Pultenaea elliptica	2	0.68	2	0.18	positive
Stylidium productum	2	0.74	2	0.05	positive
Thelymitra venosa	1	0.11	0	0.00	positive
Xanthosia tridentata	2	0.58	2	0.20	positive
Entolasia stricta	2	0.21	2	0.55	negative
Corymbia gummifera	3	0.84	2	0.50	constant

MU35 Upper Georges River Sandstone Woodland

❑ *DESCRIPTION*

Upper Georges River Sandstone Woodland (NPWS, 2000c) describes a community occurring in a narrow band along the western boundary of the Metropolitan Catchment. It is a moderately tall woodland characterised by *Eucalyptus punctata* and *Corymbia gummifera*. A large number of additional tree species can co-occur including *Eucalyptus oblonga*, *Angophora costata, E. racemosa*, *E. pilularis*, *E. sieberi* and *E. piperita*. Small trees *Allocasuarina littoralis* and *Angophora bakeri* occur just below the canopy. Typical shrub species include *Acacia ulicifolia*, *A. terminalis, A. linifolia*, *Persoonia linearis*, *Leptospermum trinervium* and *Exocarpos strictus*. *Banksia spinulosa* var. *spinulosa* and *Hakea dactyloides* occur occasionally. The ground stratum is often dominated by grass species such as *Entolasia stricta*, *Themeda australis*, *Austrostipa pubescens* and *Aristida vagans*. Other ground covers include *Dianella revoluta*, *Pomax umbellata*, *Lepidosperma laterale*, *Cyathochaeta diandra*, *Lomandra multiflora* subsp. *multiflora* and *L. cylindrica*.

Both French *et al.* (2000) and NPWS (2000c) suggest that residual shale soils are likely to be mixing with the quartz sandstone of the Mittagong series forming a slightly richer substrate. The characteristic grass cover in combination with high frequency of *Eucalyptus punctata* and *Allocasuarina littoralis* may be indicative of higher soil fertility. These features were used wherever possible to highlight boundaries between surrounding sandstone woodlands. However, variation within this community tends to be marked by an increased composition of sandstone woodland species as distance from shale soil increases.

Outside of the Metropolitan Catchment this community occurs between Appin and Holsworthy in the Georges River Catchment (NPWS, 2000c). It is suggested that a similar community is likely to occur along the north-western boundary of the Cumberland Plain near Baulkham Hills.

❑ *FLORISTIC SUMMARY*

Number of Sites: 45

Trees: 12-25m tall. Mean Projected Canopy Cover 20%

Eucalyptus punctata, Corymbia gummifera, Eucalyptus globoidea, Eucalyptus oblonga (including hybrids)*, Eucalyptus racemosa, Angophora costata, Eucalyptus eugenioides, Eucalyptus piperita, Eucalyptus sieberi, Eucalyptus fibrosa*

Small Tree: 8-12m tall. Mean Projected Canopy Cover 10%

Allocasuarina littoralis, Angophora bakeri

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

Acacia ulicifolia, Acacia terminalis, Acacia linifolia, Persoonia linearis, Leptospermum trinervium, Exocarpos strictus, Banksia spinulosa var. *spinulosa, Hakea dactyloides*

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

Entolasia stricta, Themeda australis, Austrostipa pubescens, Aristida vagans, Dianella revoluta, Pomax umbellata, Lepidosperma laterale, Cyathochaeta diandra, Lomandra multiflora subsp. *multiflora*

❑ *KEY IDENTIFYING FEATURES*

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

- Broad ridges and upper slopes along the western band of the Metropolitan Catchment. Generally doesn't extend beyond one kilometre from the boundary of shale soils
- Presence of Grey gum (*Eucalyptus punctata*) and Red bloodwood (*Corymbia gummifera*) in the canopy. Stringybark (*E. oblonga*) and Scribbly gum (*E. racemosa*) are common with greater sandstone influence. Smooth-barked apple (*Angophora costata*) is more common north of Appin.
- Small tree layer that may include Black sheoak (*Allocasuarina littoralis*) and Narrow-leaved apple (*Angophora bakeri*).
- The ground cover tends to be grassy with a dominance of Wiry panic (*Entolasia stricta*), Kangaroo grass (*Themeda australis*), *Austrostipa pubescens* and Threeawn speargrass (*Aristida vagans*).

❑ *EXAMPLE LOCATIONS*

End of Fire Trail 4, Nepean Catchment; Fire Trail 8, Wilton Area, Cataract Catchment

❑ *CONSERVATION STATUS*

BIOREGIONAL STATUS

Total Area within Sydney Basin Bioregion (ha)	Proportion of Bioregional Area within NPWS Reserve (%)	Area within Catchment (ha)	Proportion of Bioregional Area within Catchment (%)
7102	1.6	1950.23	27.5

CONDITION ASSESSMENT

Disturbance Class	Area (ha)	Proportion Extant (%)
A Light	1806.35	92.6
B Moderate	121.33	6.2
C Heavy	19.43	1.0
Scattered trees	3.12	0.2
Total	1950.23	100

❑ *THREATENED PLANT SPECIES*

Acacia bynoeana (E1), *Epacris purpurascens* var. *purpurascens* (V), *Melaleuca deanei* (V)

❑ *DIAGNOSTIC SPECIES*

Species Name	Group Score	Group Freq	Non Group Score	Non Group Freq	Fidelity Class
Acacia linifolia	2	0.65	1	0.07	positive
Acacia terminalis	2	0.72	2	0.12	positive
Acacia ulicifolia	2	0.83	1	0.13	positive
Acianthus pusillus	2	0.02	0	0.00	positive
Allocasuarina littoralis	3	0.74	2	0.21	positive
Aristida vagans	2	0.61	2	0.47	positive
Austrodanthonia linkii	2	0.65	2	0.10	positive
Cassinia arcuata	2	0.02	0	0.00	positive
Cassytha pubescens	2	0.70	2	0.11	positive
Corymbia gummifera	3	0.83	2	0.16	positive
Cryptandra propinqua	1	0.02	0	0.00	positive
Cyathochaeta diandra	2	0.74	3	0.12	positive
Dianella revoluta var. revoluta	2	0.93	2	0.30	positive
Dillwynia retorta	2	0.50	2	0.08	positive
Entolasia stricta	3	0.98	3	0.47	positive
Eucalyptus capitellata	1	0.02	0	0.00	positive
Eucalyptus oblonga	2	0.50	2	0.03	positive
Eucalyptus punctata	4	0.87	3	0.20	positive
Exocarpos strictus	2	0.61	1	0.08	positive
Gonocarpus tetragynus	2	0.52	2	0.18	positive
Hakea sericea	2	0.59	2	0.13	positive
Kunzea ambigua	2	0.52	2	0.17	positive
Lepidosperma laterale	2	0.78	2	0.39	positive
Leptospermum trinervium	2	0.70	2	0.18	positive
Lissanthe strigosa	2	0.61	2	0.17	positive
Lomandra cylindrica	2	0.63	2	0.09	positive
Lomandra multiflora subsp. multiflora	2	0.74	2	0.49	positive
Lomandra obliqua	2	0.96	2	0.16	positive
Monotoca scoparia	2	0.57	1	0.07	positive
Persoonia linearis	2	0.72	2	0.28	positive
Phyllanthus hirtellus	2	0.93	2	0.21	positive
Pimelea linifolia subsp. linifolia	2	0.70	2	0.21	positive
Poa labillardieri	2	0.52	2	0.18	positive
Pomax umbellata	2	0.80	2	0.30	positive
Schoenus villosus	1	0.02	0	0.00	positive
Stipa pubescens	3	0.78	2	0.17	positive

Species Name	Group Score	Group Freq	Non Group Score	Non Group Freq	Fidelity Class
Xanthorrhoea concava	2	0.50	1	0.05	positive
Bursaria spinosa	1	0.07	3	0.63	negative
Cheilanthes sieberi subsp. sieberi	2	0.46	2	0.62	negative
Dichondra repens	1	0.02	3	0.60	negative
Microlaena stipoides var. stipoides	1	0.61	3	0.78	negative
Themeda australis	3	0.83	3	0.60	constant

MU36 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 five 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* var. *flabellatus* cover the rocky ground.

This community has been identified on the basis of the uniqueness *of Eucalyptus dendromorpha* in the Special Areas. Budawang Ash Mallee Scrub shares many species with those occurring within Cliffline Coachwood Scrub (Map Unit 5) 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 5. 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. Within the Special Areas patches of this community are small in area and disjunct.

❑ *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 var. *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 flabellatus* var. *flabellatus, Blechnum* spp., and *Calochlaena dubia*) between and across rocks and boulders.

❑ *EXAMPLE LOCATIONS*

Wombarra Clifftops; Mt. Kembla Clifftops

❑ *CONSERVATION STATUS*

BIOREGIONAL STATUS

Total Area within Sydney Basin Bioregion (ha)	Proportion of Bioregional Area within NPWS Reserve (%)	Area within Catchment (ha)	Proportion of Bioregional Area within Catchment (%)
>25	35	12.17	48.7

CONDITION ASSESSMENT

Disturbance Class	Area (ha)	Proportion Extant (%)
A Light	12.17	100
B Moderate	0	0
C Heavy	0	0
Scattered trees	0	0
Total	12.17	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

Species Name	Group Score	Group Freq	Non Group Score	Non Group Freq	Fidelity Class
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
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

MU37 Dwarf Apple Heath

❑ *DESCRIPTION*

A low heath characterised by *Angophora hispida* occurs on flat poorly drained sandstone plateaux in the north west of the Study Area. *Leptospermum trinervium*, *Banksia oblongifolia*, *Ptilothrix deusta* and *Hakea dactyloides* are commonly associated species amongst the heath. At times a sparse canopy of *Eucalyptus racemosa*, *Corymbia gummifera* and *Banksia serrata* occurs above the heath stratum. The underlying soil tends to be damp, and supports a moderately dense ground cover that includes *Dampiera stricta*, *Cyathochaeta diandra*, *Lepyrodia scariosa*, *Lomandra glauca* and *Actinotus minor*.

Sites describing this community have been drawn from the Holsworthy Military Area (French *et al.*, 2000) and have been described as a Woodland/Heath Complex in that publication and in NPWS (2000a). French *et al.* (2000) indicate that laterite is the predominant parent material of this community, with it most often occupying shallow depressions at the head of creek tributaries. Within the Study Area, this community are restricted to a single location in O'Hares Catchment. It may also be present within the north western margins of Woronora Catchment.

Dwarf Apple Heaths are found on similar habitats in Yengo, Dharug, Brisbane Water and Ku-ring-gai Chase National Parks to the north of the Study Area. Minor variations occur in floristic composition depending on location (Keith, 1994).

❑ *FLORISTIC SUMMARY*

Number of Sites: ***18***

Trees: 8-12m tall. Mean Projected Canopy Cover 10%

Eucalyptus haemastoma/racemosa, Eucalyptus oblonga, Eucalyptus squarrosa, Corymbia gummifera, Banksia serrata

Shrubs: 2-4m tall. Mean Projected Canopy Cover 35%

Leptospermum trinervium, Banksia spinulosa var. *spinulosa, Banksia ericifolia, Angophora hispida, Petrophile sessilis, Ptilothrix deusta, Hakea dactyloides, Isopogon anemonifolius, Lambertia formosa, Hovea linearis, Leucopogon microphyllus* var. *microphyllus, Pultenaea elliptica, Pimelea linifolia, Persoonia levis*

Ground covers: 0-0.5 m tall. Mean Projected Canopy Cover 30%

Actinotus minor, Lepyrodia scariosa, Dampiera stricta, Cyathochaeta diandra, Lomandra glauca, Xanthorrhoea resinifera, Patersonia sericea, Lomandra obliqua

❑ *KEY IDENTIFYING FEATURES*

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

- An open heath complex located on broad ridges or flat topped spurs. Parent material includes a mantle of lateritic ironstone in north of Appin Road.
- A heath that comprises the low shrub Dwarf apple (*Angophora hispida*) in combination with Banksias, Hakeas and Tea-trees (*Leptospermum* spp.).
- A sparse cover of Eucalypts that are most frequently Scribbly gums (*Eucalyptus haemastoma/racemosa*).

❑ *EXAMPLE LOCATIONS*

Fire Trail 10B, O'Hares Catchment; Holsworthy Military Area

❑ *CONSERVATION STATUS*

BIOREGIONAL STATUS

Total Area within Sydney Basin Bioregion (ha)	Proportion of Bioregional Area within NPWS Reserve (%)	Area within Catchment (ha)	Proportion of Bioregional Area within Catchment (%)
>500	50	12.34	2.5

CONDITION ASSESSMENT

Disturbance Class	Area (ha)	Proportion Extant (%)
A Light	12.34	100
B Moderate	0	0
C Heavy	0	0
Scattered trees	0	0
Total	12.34	100

❑ *THREATENED PLANT SPECIES*

None recorded

❑ *DIAGNOSTIC SPECIES*

Species Name	Group Score	Group Freq	Non Group Score	Non Group Freq	Fidelity Class
Allocasuarina diminuta subsp. mimica	3	0.17	0	0.00	positive
Angophora hispida	2	0.94	2	0.03	positive
Banksia ericifolia subsp. ericifolia	2	0.56	2	0.35	positive

Species Name	Group Score	Group Freq	Non Group Score	Non Group Freq	Fidelity Class
Banksia oblongifolia	2	0.78	2	0.21	positive
Banksia spinulosa var. spinulosa	2	0.56	2	0.45	positive
Cyathochaeta diandra	2	0.94	2	0.31	positive
Grevillea sericea	2	0.50	2	0.08	positive
Hibbertia incana	1	0.06	0	0.00	positive
Kunzea capitata	2	0.61	2	0.05	positive
Lasiopetalum parviflorum	1	0.06	0	0.00	positive
Lepyrodia scariosa	2	0.89	2	0.32	positive
Lomandra glauca	2	0.61	2	0.19	positive
Petrophile sessilis	2	1.00	2	0.12	positive
Ptilothrix deusta	3	0.83	2	0.12	positive
Pultenaea elliptica	2	0.78	2	0.18	positive
Schoenus moorei	2	0.11	0	0.00	positive
Schoenus villosus	1	0.22	0	0.00	positive
Xanthorrhoea resinifera	2	0.50	2	0.18	positive
Corymbia gummifera	1	0.39	2	0.52	negative
Entolasia stricta	1	0.56	2	0.53	negative

MU38 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 (Keith,1994) and Joadja Nature Reserve (Pers obs).

❑ *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*

BIOREGIONAL STATUS

Total Area within Sydney Basin Bioregion (ha)	Proportion of Bioregional Area within NPWS Reserve (%)	Area within Catchment (ha)	Proportion of Bioregional Area within Catchment (%)
>80	5.3	78.96	98.7

CONDITION ASSESSMENT

Disturbance Class	Area (ha)	Proportion Extant (%)
A Light	78.96	100
B Moderate	0	0
C Heavy	0	0
Scattered trees	0	0
Total	78.96	100

❑ *THREATENED PLANT SPECIES*

Monotoca ledifolia (3RC-)

❑ *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

MU39 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*. Rock Pavement Heath (MU38) 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 39 is found in Royal and Morton National Parks (NPWS 2000a) 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*), Whipstick ash (*E. multicaulis*) and *E. apiculata*.
- 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*

BIOREGIONAL STATUS

Total Area within Sydney Basin Bioregion (ha)	Proportion of Bioregional Area within NPWS Reserve (%)	Area within Catchment (ha)	Proportion of Bioregional Area within Catchment (%)
>1530	46	822.07	53.7

CONDITION ASSESSMENT

Disturbance Class	Area (ha)	Proportion Extant (%)
A Light	822.07	100
B Moderate	0	0
C Heavy	0	0
Scattered trees	0	0
Total	822.07	100

❑ *THREATENED PLANT SPECIES*

Eucalyptus apiculata (3RC-), *E. luehmanniana* (2RCa)

❑ *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

MU40 Woronora Tall Mallee-Heath

❑ *DESCRIPTION*

Woronora Tall Mallee-Heath occurs as isolated patches on ridgetops of the north eastern Woronora and O'Hares Catchments. This community is a structural variation of the surrounding sandstone heaths and woodlands. The characteristic species is the mallee *Eucalyptus luehmanniana* that occurs in dense clumps amongst other typical species such as *Corymbia gummifera* and *E. racemosa*. The heathy shrubs are common to adjoining sandstone ridgetop vegetation. The most prominent include *Leptospermum trinervium*, *Hakea dactyloides, Banksia ericifolia* subsp. *ericifolia* and *B. serrata.* Smaller shrubs include *Acacia ulicifolia*, *Eriostemon australasius*, *Daviesia corymbosa* and *Kunzea capitata*. Ground covers are similarly typical of surrounding sandstone communities, including *Actinotus minor*, *Dampiera stricta*, *Entolasia stricta*, *Cyathochaeta diandra*, *Lomandra obliqua* and *Lindsaea linearis*.

Woronora Tall Mallee-Heath is closely related to other Mallee Heath communities (Map Units 39 and 34) and other sandstone woodlands. The decision to identify this community is based on structural characteristics rather than floristic differences with surrounding vegetation.

Keith (1994) notes that Mallee-Heath complexes dominated by *Eucalyptus luehmanniana* reach its southern limit in the O'Hares Catchment. Elsewhere, similar communities are recorded from Royal, Garigal, Ku-ring-gai Chase and Brisbane Waters National Parks.

❑ *FLORISTIC SUMMARY*

Number of Sites: ***19***

Trees: 6-10m tall. Mean Projected Canopy Cover 25%

Eucalyptus luehmanniana, Corymbia gummifera, Eucalyptus racemosa

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

Banksia serrata, Banksia ericifolia subsp. *ericifolia, Banksia oblongifolia, Hakea dactyloides, Leptospermum trinervium, Acacia ulicifolia, Epacris microphylla* var. *microphylla, Petrophile pulchella, Grevillea oleoides, Isopogon anemonifolius, Leptospermum arachnoides, Platysace linearifolia*

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

Actinotus minor, Dampiera stricta, Lepyrodia scariosa, Lomandra obliqua, Cyathochaeta diandra, Lindsaea linearis

❑ *KEY IDENTIFYING FEATURES*

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

- Dense cluster of the Yellow-top ash (*Eucalyptus luehmanniana*).
- Found on shallow soils on rocky knolls and on shallow sands of broad sandstone plateaus of the O'Hares and Woronora Catchments.
- Dense Heath of Banksias (*B. serrata*, *B. ericifolia* subsp. *ericifolia*, *B. oblongifolia*), Hakeas, Tea-trees (*Leptospermum trinervium, L. arachnoides*) and Wattles (*Acacia ulicifolia, A. suaveolens*).

❑ *EXAMPLE LOCATIONS*

Intersection Fire Trail 9 and 9E, Eastern side of Fire Trail 9G, Fire Trail 9H (Woronora Catchment).

❑ *CONSERVATION STATUS*

BIOREGIONAL STATUS

Total Area within Sydney Basin Bioregion (ha)	Proportion of Bioregional Area within NPWS Reserve (%)	Area within Catchment (ha)	Proportion of Bioregional Area within Catchment (%)
>547	5.2	547.44	100

CONDITION ASSESSMENT

Disturbance Class	Area (ha)	Proportion Extant (%)
A Light	547.44	100
B Moderate	0	0
C Heavy	0	0
Scattered trees	0	0
Total	547.44	100

❑ *THREATENED PLANT SPECIES*

Eucalyptus luehmanniana (2RCa)

❑ *DIAGNOSTIC SPECIES*

(The Diagnostic Species presented here are identical to those used to identify Map Unit 34. Structural characteristics and the presence of *Eucalyptus luehmanniana* have been used to distinguish these assemblages in the field.)

Species Name	Group Score	Group Freq	Non Group Score	Non Group Freq	Fidelity Class
Acacia suaveolens	2	0.74	1	0.31	positive
Actinotus minor	2	1.00	2	0.28	positive
Anisopogon avenaceus	2	0.58	2	0.12	positive
Banksia ericifolia subsp. ericifolia	3	0.95	2	0.33	positive
Banksia oblongifolia	3	0.74	2	0.21	positive
Banksia serrata	2	0.74	2	0.36	positive
Bossiaea ensata	2	0.58	1	0.13	positive
Callistemon rigidus	1	0.05	0	0.00	positive
Cyathochaeta diandra	2	0.53	2	0.32	positive
Dampiera stricta	2	0.95	2	0.34	positive
Epacris microphylla var. microphylla	2	1.00	2	0.18	positive
Eucalyptus luehmanniana	3	0.53	3	0.02	positive
Eucalyptus racemosa	3	0.74	2	0.28	positive
Glossodia minor	1	0.05	0	0.00	positive
Goodenia stelligera	1	0.05	0	0.00	positive
Grevillea oleoides	2	0.95	2	0.22	positive
Grevillea sphacelata	2	0.53	1	0.15	positive
Hakea dactyloides	2	0.89	2	0.37	positive
Hakea teretifolia	2	0.89	2	0.21	positive
Isopogon anemonifolius	2	0.89	2	0.39	positive
Lambertia formosa	2	0.74	2	0.36	positive
Leptocarpus tenax	2	0.58	2	0.12	positive
Leptospermum arachnoides	2	0.84	1	0.16	positive
Leptospermum polygalifolium subsp. polygalifolium	2	0.63	2	0.09	positive
Lepyrodia scariosa	2	0.89	2	0.32	positive
Leucopogon esquamatus	2	0.79	1	0.06	positive
Lomandra obliqua	2	0.74	2	0.44	positive
Petrophile pulchella	2	0.95	2	0.28	positive
Platysace linearifolia	2	0.79	2	0.38	positive
Pultenaea elliptica	2	0.68	2	0.18	positive
Stylidium productum	2	0.74	2	0.05	positive
Thelymitra venosa	1	0.11	0	0.00	positive
Xanthosia tridentata	2	0.58	2	0.20	positive
Entolasia stricta	2	0.21	2	0.55	negative
Corymbia gummifera	3	0.84	2	0.50	constant

MU41 Highlands Sandstone *Allocasuarina* Heath

❑ *DESCRIPTION*

At The Racecourse, in the far south west of the Nepean Catchment, a low dense heath covers an extensive area. This low heath comprises *Allocasuarina diminuta* subsp. *mimica*, *A. paludosa*, *Banksia spinulosa* var. *spinulosa*, *B. oblongifolia, Hakea dactyloides, Isopogon anemonifolius* and *Grevillea sericea*. The ground cover is a mix of *Cyathochaeta diandra*, *Lepyrodia scariosa*, *Lachnagrostis filiformis*, *Austrostipa pubescens* and *Poa labillardieri* var. *labillardieri*. Small shrubs also occupy the ground layer and these include *Gonocarpus* spp., *Hibbertia serpyllifolia* and *Pultenaea elliptica*. A low very sparse cover of *Eucalyptus racemosa* is often present on the fringe of the heath. The species composition is unchanged at sites that include the Eucalypt overstorey. This community forms a complex with Map Unit 31 and has been distinguished using the structural characteristics of the vegetation observable on aerial photographs.

Benson & Howell (1994) suggest that Highlands Sandstone *Allocasuarina* Heath is occurring on the last remnants of the Mittagong Formation Sandstones. They also note that this community is unusual in that it only occurs at isolated patches around Sydney between the coast at Kingsford and Heathcote and at higher elevations at Blackheath and Taralga. *Allocasuarina diminuta* subsp. *mimica* has been recorded within Dwarf Apple Heath (MU37), although the total floristic composition of this community is poorly related.

❑ *FLORISTIC SUMMARY*

Number of Sites: ***6***

Small Trees: 6-10m tall. Mean Projected Canopy Cover 5%

Eucalyptus racemosa/sclerophylla

Shrubs: 0.5-1.5 m tall. Mean Projected Canopy Cover 70%

Allocasuarina paludosa, Banksia spinulosa var. *spinulosa, Allocasuarina diminuta* subsp. *mimica, Banksia oblongifolia, Hakea dactyloides, Isopogon anemonifolius, Grevillea sericea*

Ground covers: 0.5-1m tall. Mean Projected Canopy Cover 85%

Cyathochaeta diandra, Lepyrodia scariosa, Dampiera stricta

❑ *KEY IDENTIFYING FEATURES*

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

- Single location at The Racecourse in Nepean Catchment. Low Heath (less than two metres) dominated by *Allocasuarina paludosa* and *A. diminuta* subsp. *mimica.*

❑ *EXAMPLE LOCATIONS*

Fire Trail 2H, Nepean Catchment

❑ *CONSERVATION STATUS*

BIOREGIONAL STATUS

Total Area within Sydney Basin Bioregion (ha)	Proportion of Bioregional Area within NPWS Reserve (%)	Area within Catchment (ha)	Proportion of Bioregional Area within Catchment (%)
>59	0	59.41	100

CONDITION ASSESSMENT

Disturbance Class	Area (ha)	Proportion Extant (%)
A Light	59.41	100
B Moderate	0	0
C Heavy	0	0
Scattered trees	0	0
Total	59.41	100

❑ *THREATENED PLANT SPECIES*

None recorded

❑ *DIAGNOSTIC SPECIES*

Species Name	Group Score	Group Freq	Non Group Score	Non Group Freq	Fidelity Class
Allocasuarina paludosa	3	0.80	1	0.01	positive
Austrostipa pubescens	2	1.00	2	0.14	positive
Banksia oblongifolia	2	0.80	2	0.22	positive
Banksia spinulosa var. spinulosa	3	1.00	2	0.45	positive
Cyathochaeta diandra	2	1.00	2	0.32	positive
Dampiera stricta	2	1.00	2	0.36	positive
Eucalyptus racemosa	2	1.00	2	0.29	positive
Gonocarpus tetragynus	2	1.00	2	0.14	positive
Goodenia bellidifolia subsp. bellidifolia	2	1.00	2	0.14	positive
Grevillea sericea	2	0.60	2	0.09	positive
Hakea dactyloides	3	1.00	2	0.38	positive

Species Name	Group Score	Group Freq	Non Group Score	Non Group Freq	Fidelity Class
Hibbertia serpyllifolia	2	1.00	1	0.05	positive
Hypericum gramineum	2	0.80	1	0.04	positive
Isopogon anemonifolius	2	0.80	2	0.40	positive
Lepyrodia scariosa	2	0.80	2	0.33	positive
Lindsaea linearis	2	1.00	2	0.25	positive
Lomandra multiflora subsp. multiflora	2	0.60	2	0.22	positive
Mitrasacme polymorpha	2	1.00	2	0.15	positive
Poa labillardierei var. labillardierei	2	0.60	2	0.04	positive
Pultenaea elliptica	2	1.00	2	0.19	positive
Corymbia gummifera	0	0.00	2	0.52	negative
Entolasia stricta	2	1.00	2	0.53	constant

MU42 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 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 (Map Unit 29). 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. Similar thickets occur south of the Special Area in Barren Grounds Nature Reserve and Morton National Park.

❑ *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 forma *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.

❑ *EXAMPLE LOCATIONS*

Maddens Plains; Stanwell Tops

❑ *CONSERVATION STATUS*

BIOREGIONAL STATUS

Total Area within Sydney Basin Bioregion (ha)	Proportion of Bioregional Area within NPWS Reserve (%)	Area within Catchment (ha)	Proportion of Bioregional Area within Catchment (%)
>47000	89	1120.03	n/a

Upland Swamp communities have not been mapped separately outside this report.

CONDITION ASSESSMENT

Disturbance Class	Area (ha)	Proportion Extant (%)
A Light	1117.94	99.8
B Moderate	1.91	0.2
C Heavy	0.18	0.0
Scattered trees	0	0
Total	1120.03	100

❑ *THREATENED PLANT SPECIES*

Pultenaea aristata (V)

❑ *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

Species Name	Group Score	Group Freq	Non Group Score	Non Group Freq	Fidelity Class
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

MU43 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 and L.polygaslifoilum* subsp. *polygalifolium)*), *Acacia rubida*, *Banksia ericifolia* subsp. *ericifolia* and *Melaleuca squarrosa* may form dense thickets to a height of three metres. 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. Similar vegetation occurs on drainage lines within upland swamp complexes found on Sandstone Plateaux elsewhere in the Sydney Basin.

❑ *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, Leptospermum (polygalifolium* subsp. *polygalifolium)*

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 with occasional *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*

BIOREGIONAL STATUS

Total Area within Sydney Basin Bioregion (ha)	Proportion of Bioregional Area within NPWS Reserve (%)	Area within Catchment (ha)	Proportion of Bioregional Area within Catchment (%)
>47000	89	170.46	n/a

Upland Swamp communities have not been mapped separately outside this report.

CONDITION ASSESSMENT

Disturbance Class	Area (ha)	Proportion Extant (%)
A Light	170.46	100
B Moderate	0	0
C Heavy	0	0
Scattered trees	0	0
Total	170.46	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

Species Name	Group Score	Group Freq	Non Group Score	Non Group Freq	Fidelity Class
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

MU44 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 ten percent 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

❑ *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

Species Name	Group Score	Group Freq	Non Group Score	Non Group Freq	Fidelity Class
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
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 subsp. *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	0.00	positive
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.

BIOREGIONAL STATUS

Total Area within Sydney Basin Bioregion (ha)	Proportion of Bioregional Area within NPWS Reserve (%)	Area within Catchment (ha)	Proportion of Bioregional Area within Catchment (%)
>47000	89	3448.64	n/a

Upland Swamp communities have not been mapped separately outside this report.

CONDITION ASSESSMENT

Disturbance Class	Area (ha)	Proportion Extant (%)
A Light	3448.25	100.0
B Moderate	0.39	0.0
C Heavy	0	0
Scattered trees	0	0
Total	3448.64	100

❑ *THREATENED PLANT SPECIES*

Acacia baueri subsp. *aspera* (V), *Pultenaea aristata* (V), *Monotoca ledifolia* (3RC-)

MU45 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 consisting of 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 44b) than Exposed Sandstone Scribbly Gum Woodland (Map Unit 29).

Mapping used for the O'Hares Creek Catchment (Keith, 1994) does not distinguish this structural variation from the MU44 Sedgeland-Heath complex. Similar vegetation occurs on drainage lines within upland swamp complexes found on Sandstone Plateaux elsewhere in the Sydney Basin.

❑ *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*

BIOREGIONAL STATUS

Total Area within Sydney Basin Bioregion (ha)	Proportion of Bioregional Area within NPWS Reserve (%)	Area within Catchment (ha)	Proportion of Bioregional Area within Catchment (%)
>47000	89	1579.95	n/a

Upland Swamp communities have not been mapped separately outside this report.

CONDITION ASSESSMENT

Disturbance Class	Area (ha)	Proportion Extant (%)
A Light	1579.95	100
B Moderate	0	0
C Heavy	0	0
Scattered trees	0	0
Total	1579.95	100

❑ *THREATENED PLANT SPECIES*

Epacris purpurascens var. *purpurascens* (V), *Pultenaea aristata* (V), *Darwinia grandiflora* (2RC-), *Eucalyptus apiculata* (3RC-)

❑ *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

Species Name	Group Score	Group Freq	Non Group Score	Non Group Freq	Fidelity Class
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

MU46 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*.

Outside of the Special Areas this community is found within the sandstone plateau of Morton National Park amongst the Upland Swamp complex.

❑ *FLORISTIC SUMMARY*

Number of Sites: ***none***

Shrubs: 1.5m tall. Mean Projected Canopy Cover 5-35% cover

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 Banksias, 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*

BIOREGIONAL STATUS

Total Area within Sydney Basin Bioregion (ha)	Proportion of Bioregional Area within NPWS Reserve (%)	Area within Catchment (ha)	Proportion of Bioregional Area within Catchment (%)
>47000	89	124.49	n/a

Upland Swamp communities have not been mapped separately outside this report. Occurrence outside of the catchment poorly known.

CONDITION ASSESSMENT

Disturbance Class	Area (ha)	Proportion Extant (%)
A Light	124.49	100
B Moderate	0	0
C Heavy	0	0
Scattered trees	0	0
Total	124.49	100

❑ *THREATENED PLANT SPECIES*

Eucalyptus apiculata (3RC-)

❑ *DIAGNOSTIC SPECIES*

No Diagnostic Species List available as no survey sites were undertaken in this community.

MU47 Highlands Sandstone Swamp Woodland

❑ *DESCRIPTION*

Highlands Sandstone Swamp Woodland occurs on the Mittagong Formation Sandstones above 500 metres in elevation. The distribution of the community closely follows minor drainage lines and depressions of broad plateaux. The canopy is generally open and includes *Eucalyptus ovata*, *E. radiata* subsp. *radiata*, *E mannifera* subsp. *mannifera* and *E. globoidea*. Drainage lines have sporadic dense thickets of *Leptospermum polygalifolium* subsp. *polygalifolium* occurring with *Banksia spinulosa* var. *spinulosa* and *Acacia rubida*. Ground cover also varies depending on moisture gradient. At permanently soaked sites rushes such as *Juncus continuus* and *Eleocharis sphacelata* may feature prominently. *Lomandra longifolia*, *Pteridium esculentum* and *Entolasia stricta* are more common on the fringe sometimes with *Mirbelia platylobioides*.

Highlands Sandstone Swamp Woodland occupies the headwaters of streams that flow out onto the shale plains of the Southern Highlands. Some floristic similarity is likely between this community and Highlands Alluvial Red Gum Woodland (Map Unit 24) on alluvial flats and Highlands Swamp Gum-*Melaleuca* Woodland (Map Unit 48).

❑ *FLORISTIC SUMMARY*

Number of Sites: ***none***

Trees: 5-12m tall. Mean Projected Canopy Cover 5-15% cover

Eucalyptus ovata, Eucalyptus radiata subsp. *radiata, Eucalyptus mannifera* subsp. *mannifera, Eucalyptus globoidea*

Shrubs: 1-3m tall. Mean Projected Canopy Cover 5-45% cover

Leptospermum polygalifolium subsp. *polygalifolium*

Ground: up to 1m tall. Mean Projected Canopy Cover 60-70% cover

Lomandra longifolia, Pteridium esculentum, Cyathochaeta diandra, Entolasia stricta

❑ *KEY IDENTIFYING FEATURES*

Easily recognisable features to assist in identifying this map unit are

- Low open woodland occurring on minor drainage flats and channels on Mittagong sandstone at elevations above 500 metres.

❑ *EXAMPLE LOCATIONS*

Fire Trail 3, minor creek crossing south of Chain of ponds Creek

❑ *CONSERVATION STATUS*

BIOREGIONAL STATUS

Total Area within Sydney Basin Bioregion (ha)	Proportion of Bioregional Area within NPWS Reserve (%)	Area within Catchment (ha)	Proportion of Bioregional Area within Catchment (%)
>440	0	439.60	100

CONDITION ASSESSMENT

Disturbance Class	Area (ha)	Proportion Extant (%)
A Light	439.60	100
B Moderate	0	0
C Heavy	0	0
Scattered trees	0	0
Total	439.60	100

❑ *THREATENED PLANT SPECIES*

Eucalyptus apiculata (3RC-)

❑ *DIAGNOSTIC SPECIES*

No Diagnostic Species List available as no survey sites were undertaken in this community.

MU48 Highlands Swamp Gum-*Melaleuca* Woodland

❑ *DESCRIPTION*

On the Southern Highlands Plateau in the far south of the Study Area, a unique community is associated with changes in geology between basalts, shales and sandstones. These appear to be water table discharge sites where the surface is periodically inundated by water. The composition of the community is variable depending on water availability and underlying parent material. A low canopy comprising *Eucalyptus ovata* and *Melaleuca linariifolia* is characteristic. It may support 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*. At other locations, *Eucalyptus ovata* are taller with an open grassy understorey and do not share sandstone shrub and sedge species present at sites such as 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.

❑ *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 with dense shrubs of *Melaleuca linariifolia*.
- Dense ground cover of *Schoenus melanostachys*.
- Low cover of Swamp gums (*Eucalyptus ovata*).

❑ *EXAMPLE LOCATIONS*

Macquarie Hill, on Fire Trail 15a; Fire Trail 1, Molly Morgan Gully

❑ *CONSERVATION STATUS*

BIOREGIONAL STATUS

Total Area within Sydney Basin Bioregion (ha)	Proportion of Bioregional Area within NPWS Reserve (%)	Area within Catchment (ha)	Proportion of Bioregional Area within Catchment (%)
>144	0.1	144.23	100

CONDITION ASSESSMENT

Disturbance Class	Area (ha)	Proportion Extant (%)
A Light	119.44	82.8
B Moderate	10.80	7.5
C Heavy	0	0
Scattered trees	13.99	9.7
Total	144.23	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	0.00	positive
Empodisma minus	4	1	4	0.01	positive
Entolasia stricta	2	1	3	0.13	positive
Eucalyptus ovata	4	1	0	0.00	positive
Gonocarpus teucrioides	4	1	3	0.05	positive
Goodenia paniculata	2	1	0	0.00	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
Lomandra longifolia	5	1	2	0.45	positive

Species Name	Group Score	Group Freq	Non Group Score	Non Group Freq	Fidelity Class
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	0.00	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

Disturbed Landscapes

❑ *MU49A REGENERATING VEGETATION – ACACIA SCRUBS*

Area: 362.09 (ha)

A number of Acacia species (*A. mearnsii*, *A. maidenii*, *A. binervata*, and *A. melanoxylon*) recolonise cleared or heavily disturbed native vegetation. These Acacias often form dense scrubs on a wide variety of regenerating habitats and environments. In disturbed rainforest, *Acacia melanoxylon* or *A. mearnsii* 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.

❑ *MU49B REGENERATING VEGETATION – REGENERATING TURPENTINE*

Area: 81.39 (ha)

Turpentine (*Syncarpia glomulifera* subsp. *glomulifera*) forms monospecific stands of regrowth trees on Narrabeen Shale and Sandstone cleared of all native vegetation. The floristic composition is a simple one, with a ground cover of *Lomandra longifolia* and *Pteridium esculentum* most common. Cataract Catchment supports the most extensive area of Turpentine regeneration. These areas also flag potential weed invasion from species such as Crofton weed (*Ageratina adenophora*).

❑ *MU49C REGENERATING VEGETATION – ALLOCASUARINA HEATH REGENERATION*

Area: 4.50 (ha)

In drier habitats on shale soils, Black sheoak (*Allocasuarina littoralis*) tends to rapidly recolonise disturbed areas. Examples of these heaths occur in the Woronora Catchment amongst O'Hares Creek Shale Forest.

❑ *MU50 WEEDS AND EXOTICS*

Area: 170.98 (ha)

Infestation by weeds and other exotic species is uncommon in the catchment areas of the Woronora Plateau. These areas are prominent on former grazing and mining sites and along the various fire and service trails. 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 Willows (*Salix* spp.), Coral trees (*Erythrina X sykesii*) and isolated native species.

❑ *MU51 CLEARED LAND*

Area: 8672.29 (ha)

Removal of native vegetation cover for agricultural, and urban land uses is widespread across the richer soils in the south and west of the Special Areas The nature of the land use can be gleaned using the aerial photographinterpretation data associated with the GIS layer that accompanies this report.

❑ *MU52 ARTIFICIAL WETLANDS*

Area: 6.53 (ha)

Artificial Wetlands are associated with farm dams, and include dense Broad-leaved cumbungi (*Typha orientalis*) and Common reed (*Phragmites australis*). These reedlands are also found on the lake edges of the major reservoirs of the catchment. In some locations inundated areas that arose from flooding now support dense groves of *Melaleuca linariifolia*.

❑ *MU53 WATER*

Area: 3385.47 (ha)

This comprises the area of water within the various reservoirs on the plateau.

APPENDIX B: SITES BY STRATA ANALYSIS.

DEFINTION OF STRATA CODE

Code	Geology	Code	Aspect	Code	Rainfall
1	Hawkesbury Sandstone	1	North (315-45)	1	Low (749-941mm)
2	Narrabeen Group	2	East (45-315)	2	Low-Medium (942-1134mm)
3	Wianamatta Shale	3	South (135-225)	3	Medium (1135-1327mm)
4	Volcanics	4	West (225-315)	4	Medium -High (1328-1520mm)
5	Quaternary Sands (Dells)			5	High (1521-1712mm)
6	Dolerite				
7	Alluviums				
8	Mittagong Sandstone				

Example Codes: 111 – Hawkesbury Sandstone(1), North Aspect (1), Low Rainfall (1)
643 – Dolerite (6), West Aspect (4), Medium Rainfall (3)

STRATA TABLE

Strata Code	Area (Ha)	% of Study Area	Number of Sites	% of Sites	% Difference between % of area and % of sites
111	1038.6	0.7	9	1.3	-0.6
112	4801.0	3.3	19	2.7	0.6
113	6927.0	4.7	35	5.0	-0.3
114	5546.3	3.8	37	5.3	-1.5
115	1441.6	1.0	8	1.1	-0.2
121	1205.9	0.8	21	3.0	-2.2
122	4628.4	3.2	16	2.3	0.9
123	6103.3	4.2	23	3.3	0.9
124	4238.3	2.9	28	4.0	-1.1
125	830.8	0.6	4	0.6	0.0
131	713.5	0.5	6	0.9	-0.4
132	3298.4	2.3	10	1.4	0.8
133	4109.2	2.8	10	1.4	1.4
134	2645.8	1.8	12	1.7	0.1
135	733.6	0.5	5	0.7	-0.2
141	1434.5	1.0	15	2.2	-1.2
142	4755.9	3.2	17	2.4	0.8
143	5970.3	4.1	24	3.4	0.6
144	4022.0	2.7	23	3.3	-0.6
145	1194.9	0.8	7	1.0	-0.2
212	89.5	0.1	0	0.0	0.1
213	9.0	0.0	0	0.0	0.0

Strata Code	Area (Ha)	% of Study Area	Number of Sites	% of Sites	% Difference between % of area and % of sites
214	1070.3	0.7	6	0.9	-0.1
215	506.6	0.4	8	1.1	-0.8
222	152.4	0.1	0	0.0	0.1
223	26.4	0.0	0	0.0	0.0
224	1001.4	0.7	1	0.1	0.5
225	400.6	0.3	2	0.3	0.0
232	74.9	0.1	0	0.0	0.1
233	29.8	0.0	0	0.0	0.0
234	844.5	0.6	5	0.7	-0.1
235	393.9	0.3	6	0.9	-0.6
242	144.6	0.1	0	0.0	0.1
243	10.4	0.0	0	0.0	0.0
244	1030.5	0.7	7	1.0	-0.3
245	511.6	0.4	4	0.6	-0.2
311	5810.8	4.0	23	3.3	0.7
312	391.3	0.3	3	0.4	-0.2
313	587.8	0.4	0	0.0	0.4
314	563.9	0.4	1	0.1	0.2
315	209.9	0.1	1	0.1	0.0
321	3829.5	2.6	15	2.2	0.5
322	414.6	0.3	0	0.0	0.3
323	392.2	0.3	0	0.0	0.3
324	455.3	0.3	1	0.1	0.2
325	97.9	0.1	0	0.0	0.1
331	2592.0	1.8	15	2.2	-0.4
332	268.1	0.2	0	0.0	0.2
333	81.7	0.1	0	0.0	0.1
334	199.3	0.1	0	0.0	0.1
335	71.1	0.1	0	0.0	0.1
341	5223.1	3.6	19	2.7	0.8
342	238.6	0.2	0	0.0	0.2
343	280.1	0.2	0	0.0	0.2
344	339.4	0.2	0	0.0	0.2
345	99.7	0.1	0	0.0	0.1
411	0.4	0.0	0	0.0	0.0
413	23.6	0.0	0	0.0	0.0
414	168.7	0.1	1	0.1	0.0

Strata Code	Area (Ha)	% of Study Area	Number of Sites	% of Sites	% Difference between % of area and % of sites
415	16.4	0.0	0	0.0	0.0
421	0.6	0.0	0	0.0	0.0
423	8.5	0.0	0	0.0	0.0
424	171.0	0.1	1	0.1	0.0
425	0.4	0.0	0	0.0	0.0
431	0.5	0.0	0	0.0	0.0
433	11.7	0.0	1	0.1	-0.1
434	86.6	0.1	4	0.6	-0.5
435	3.4	0.0	0	0.0	0.0
441	0.3	0.0	0	0.0	0.0
443	21.3	0.0	2	0.3	-0.3
444	103.3	0.1	1	0.1	-0.1
445	13.8	0.0	0	0.0	0.0
511	47.6	0.0	0	0.0	0.0
512	117.8	0.1	0	0.0	0.1
513	7.6	0.0	0	0.0	0.0
514	2.9	0.0	0	0.0	0.0
515	22.6	0.0	0	0.0	0.0
521	102.7	0.1	0	0.0	0.1
522	135.3	0.1	0	0.0	0.1
523	6.1	0.0	0	0.0	0.0
524	4.1	0.0	1	0.1	-0.1
525	23.7	0.0	0	0.0	0.0
531	41.8	0.0	0	0.0	0.0
532	16.8	0.0	0	0.0	0.0
533	12.5	0.0	0	0.0	0.0
534	3.9	0.0	0	0.0	0.0
535	18.7	0.0	0	0.0	0.0
541	45.7	0.0	0	0.0	0.0
542	82.8	0.1	0	0.0	0.1
543	13.0	0.0	0	0.0	0.0
544	14.9	0.0	0	0.0	0.0
545	19.1	0.0	0	0.0	0.0
612	2.9	0.0	0	0.0	0.0
613	271.1	0.2	0	0.0	0.2
614	375.6	0.3	0	0.0	0.3
615	237.3	0.2	0	0.0	0.2

Strata Code	Area (Ha)	% of Study Area	Number of Sites	% of Sites	% Difference between % of area and % of sites
622	9.3	0.0	0	0.0	0.0
623	139.4	0.1	0	0.0	0.1
624	307.8	0.2	0	0.0	0.2
625	125.0	0.1	0	0.0	0.1
632	9.8	0.0	0	0.0	0.0
633	82.3	0.1	0	0.0	0.1
634	105.8	0.1	0	0.0	0.1
635	37.4	0.0	0	0.0	0.0
642	2.1	0.0	0	0.0	0.0
643	104.3	0.1	0	0.0	0.1
644	111.6	0.1	0	0.0	0.1
645	115.1	0.1	1	0.1	-0.1
711	679.4	0.5	4	0.6	-0.1
721	473.4	0.3	2	0.3	0.0
731	274.4	0.2	0	0.0	0.2
741	553.5	0.4	2	0.3	0.1
811	2563.5	1.8	26	3.7	-2.0
812	8112.9	5.5	34	4.9	0.7
813	2759.9	1.9	12	1.7	0.2
814	982.9	0.7	8	1.1	-0.5
815	389.1	0.3	3	0.4	-0.2
821	1667.7	1.1	10	1.4	-0.3
822	5864.2	4.0	22	3.2	0.9
823	2573.3	1.8	9	1.3	0.5
824	827.5	0.6	3	0.4	0.1
825	223.7	0.2	2	0.3	-0.1
831	1107.3	0.8	14	2.0	-1.3
832	4162.1	2.8	9	1.3	1.6
833	1777.3	1.2	7	1.0	0.2
834	945.4	0.6	6	0.9	-0.2
835	151.4	0.1	1	0.1	0.0
841	2326.8	1.6	25	3.6	-2.0
842	6707.1	4.6	25	3.6	1.0
843	2559.4	1.7	5	0.7	1.0
844	1459.6	1.0	11	1.6	-0.6
845	188.9	0.1	1	0.1	0.0
Total	146818.8	100	699	100	0

APPENDIX C: SPECIES LIST.

Family	Scientific Name	Common Name
Acanthaceae	Brunoniella australis	Blue Trumpet
Acanthaceae	Brunoniella pumilio	Dwarf Blue Trumpet
Acanthaceae	Pseuderanthemum variabile	Pastel Flower
Adiantaceae	Adiantum aethiopicum	Common Maidenhair
Adiantaceae	Adiantum formosum	Giant Maidenhair
Adiantaceae	Adiantum hispidulum	Rough Maidenhair
Adiantaceae	Cheilanthes distans	Bristly Cloak Fern
Adiantaceae	Cheilanthes sieberi subsp. sieberi	
Adiantaceae	Pellaea falcata	Sickle Fern
Adiantaceae	Pellaea nana	Dwarf Sickle Fern
Amaranthaceae	Deeringia amaranthoides	
Amaranthaceae	Nyssanthes diffusa	Barbwire Weed
Amygdalaceae	Prunus laurocerasus	Cherry Laurel
Amygdalaceae	Prunus lusitanica	Portugal Laurel
Anacardiaceae	Euroschinus falcata var. falcata	Ribbonwood
Anthericaceae	Alania endlicheri	
Anthericaceae	Arthropodium minus	Small Vanilla Lily
Anthericaceae	Caesia parviflora	Pale Grass-lily
Anthericaceae	Caesia parviflora var. vittata	
Anthericaceae	Dichopogon fimbriatus	Nodding Chocolate Lily
Anthericaceae	Laxmannia compacta	
Anthericaceae	Laxmannia gracilis	
Anthericaceae	Sowerbaea juncea	Vanilla Plant
Anthericaceae	Thysanotus juncifolius	
Anthericaceae	Thysanotus tuberosus subsp. tuberosus	
Anthericaceae	Thysanotus virgatus	
Anthericaceae	Tricoryne simplex	
Apiaceae	Actinotus helianthi	Flannel Flower
Apiaceae	Actinotus minor	Lesser Flannel Flower
Apiaceae	Centella asiatica	Pennywort
Apiaceae	Daucus glochidiatus	Native Carrot
Apiaceae	Hydrocotyle acutiloba	
Apiaceae	Hydrocotyle algida	
Apiaceae	Hydrocotyle laxiflora	Stinking Pennywort
Apiaceae	Hydrocotyle peduncularis	
Apiaceae	Hydrocotyle spp.	
Apiaceae	Platysace ericoides	

Family	Scientific Name	Common Name
Apiaceae	Platysace lanceolata	
Apiaceae	Platysace linearifolia	
Apiaceae	Trachymene incisa subsp. incisa	
Apiaceae	Xanthosia dissecta	
Apiaceae	Xanthosia pilosa	
Apiaceae	Xanthosia pilosa forma A	
Apiaceae	Xanthosia pilosa forma B	
Apiaceae	Xanthosia pilosa forma C	
Apiaceae	Xanthosia tridentata	
Apocynaceae	Melodinus australis	Southern Melodinus
Apocynaceae	Parsonsia brownii	Mountain Silkpod
Apocynaceae	Parsonsia straminea	Common Silkpod
Aquifoliaceae	Ilex aquifolium	Holly
Araceae	Gymnostachys anceps	Settler's Flax
Araliaceae	Astrotricha latifolia	
Araliaceae	Astrotricha longifolia	
Araliaceae	Polyscias sambucifolia	Elderberry Panax
Araliaceae	Polyscias sambucifolia subsp. A	
Araliaceae	Polyscias sambucifolia subsp. A	
Araliaceae	Polyscias sambucifolia subsp. B	
Arecaceae	Livistona australis	Cabbage Palm
Asclepiadaceae	Marsdenia australis	Doubah
Asclepiadaceae	Marsdenia flavescens	Hairy Milk Vine
Asclepiadaceae	Marsdenia rostrata	Common Milk Vine
Asclepiadaceae	Marsdenia suaveolens	Scented Marsdenia
Asclepiadaceae	Tylophora barbata	Bearded Tylophora
Asparagaceae	Protasparagus aethiopicus	Sprengeri Fern
Aspleniaceae	Asplenium australasicum forma australasicum	Bird's Nest Fern
Aspleniaceae	Asplenium bulbiferum subsp. gracillimum	Mother Spleenwort
Aspleniaceae	Asplenium flabellifolium	Necklace Fern
Aspleniaceae	Asplenium polyodon	
Asteraceae	Ageratina adenophora	Crofton Weed
Asteraceae	Bidens pilosa	Cobbler's Pegs
Asteraceae	Brachyscome angustifolia	
Asteraceae	Bracteantha bracteata	Golden Everlasting
Asteraceae	Calotis dentex	
Asteraceae	Cassinia aculeata	Dolly Bush
Asteraceae	Cassinia aureonitens	

Family	Scientific Name	Common Name
Asteraceae	Cassinia denticulata	
Asteraceae	Cassinia longifolia	
Asteraceae	Cassinia uncata	Sticky Cassinia
Asteraceae	Chrysocephalum apiculatum	Common Everlasting
Asteraceae	Chrysocephalum semipapposum	Clustered Everlasting
Asteraceae	Cirsium vulgare	Spear Thistle
Asteraceae	Conyza bonariensis	Flaxleaf Fleabane
Asteraceae	Conyza canadensis var. canadensis	Canadian Fleabane
Asteraceae	Conyza sumatrensis	Tall Fleabane
Asteraceae	Cymbonotus lawsonianus	Bear's Ear
Asteraceae	Epaltes australis	Spreading Nut-heads
Asteraceae	Euchiton involucratus	Star Cudweed
Asteraceae	Euchiton sphaericus	
Asteraceae	Helichrysum calvertianum	
Asteraceae	Helichrysum elatum	
Asteraceae	Helichrysum scorpioides	Button Everlasting
Asteraceae	Hypochaeris radicata	Catsear
Asteraceae	Lagenifera gracilis	Slender Lagenophora
Asteraceae	Lagenifera stipitata	Blue Bottle-daisy
Asteraceae	Olearia argophylla	Native Musk
Asteraceae	Olearia erubescens	Silky Daisy Bush
Asteraceae	Olearia viscidula	Wallaby Weed
Asteraceae	Ozothamnus diosmifolius	White Dogwood
Asteraceae	Senecio hispidulus var. dissectus	
Asteraceae	Senecio lautus subsp. dissectifolius	
Asteraceae	Senecio linearifolius	
Asteraceae	Senecio madagascariensis	Fireweed
Asteraceae	Senecio species E	
Asteraceae	Senecio velleioides	
Asteraceae	Sigesbeckia orientalis subsp. orientalis	Indian Weed
Asteraceae	Vernonia cinerea var. cinerea	
Athyriaceae	Diplazium australe	
Baueraceae	Bauera microphylla	
Baueraceae	Bauera rubioides	
Bignoniaceae	Pandorea pandorana	Wonga Wonga Vine
Bignoniaceae	Pandorea pandorana subsp. pandorana	
Blandfordiaceae	Blandfordia nobilis	
Blandfordiaceae	Blandfordia spp.	

Family	Scientific Name	Common Name
Blechnaceae	Blechnum ambiguum	
Blechnaceae	Blechnum camfieldii	
Blechnaceae	Blechnum cartilagineum	Gristle Fern
Blechnaceae	Blechnum indicum	Swamp Water Fern
Blechnaceae	Blechnum nudum	Fishbone Water Fern
Blechnaceae	Blechnum patersonii	Strap Water Fern
Blechnaceae	Blechnum patersonii subsp. patersonii	
Blechnaceae	Blechnum wattsii	Hard Water Fern
Blechnaceae	Doodia aspera	Prickly Rasp Fern
Boraginaceae	Austrocynoglossum latifolium	
Campanulaceae	Wahlenbergia communis	Tufted Bluebell
Campanulaceae	Wahlenbergia gracilis	Australian Bluebell
Campanulaceae	Wahlenbergia stricta subsp. stricta	
Caryophyllaceae	Polycarpon tetraphyllum	Four-leaved Allseed
Caryophyllaceae	Stellaria flaccida	
Casuarinaceae	Allocasuarina distyla	
Casuarinaceae	Allocasuarina littoralis	Black Sheoak
Casuarinaceae	Allocasuarina nana	
Casuarinaceae	Allocasuarina paludosa	
Casuarinaceae	Allocasuarina spp.	
Casuarinaceae	Allocasuarina torulosa	Forest Oak
Celastraceae	Cassine australis	Red Olive Plum
Celastraceae	Celastrus australis	Staff VIne
Celastraceae	Celastrus subspicata	
Centrolepidaceae	Centrolepis fascicularis	
Chenopodiaceae	Einadia nutans	Climbing Saltbush
Chloanthaceae	Chloanthes stoechadis	
Clusiaceae	Hypericum gramineum	Small St John's Wort
Colchicaceae	Burchardia umbellata	Milkmaids
Commelinaceae	Aneilema acuminatum	
Commelinaceae	Aneilema biflorum	
Commelinaceae	Commelina cyanea	Native Wandering Jew
Convolvulaceae	Cuscuta campestris	Golden Dodder
Convolvulaceae	Dichondra repens	Kidney Weed
Convolvulaceae	Polymeria calycina	
Cunoniaceae	Aphanopetalum resinosum	Gum Vine
Cunoniaceae	Callicoma serratifolia	Black Wattle
Cunoniaceae	Ceratopetalum apetalum	Coachwood

Family	Scientific Name	Common Name
Cunoniaceae	Ceratopetalum gummiferum	Christmas Bush
Cunoniaceae	Schizomeria ovata	Crabapple
Cupressaceae	Callitris endlicheri	Black Cypress Pine
Cupressaceae	Callitris rhomboidea	Port Jackson Pine
Cyatheaceae	Cyathea australis	Rough Treefern
Cyatheaceae	Cyathea leichhardtiana	Prickly Treefern
Cyperaceae	Baumea acuta	
Cyperaceae	Baumea articulata	Jointed Twig-rush
Cyperaceae	Baumea nuda	
Cyperaceae	Baumea rubiginosa	
Cyperaceae	Baumea teretifolia	
Cyperaceae	Carex appressa	
Cyperaceae	Carex breviculmis	
Cyperaceae	Carex declinata	
Cyperaceae	Carex fascicularis	Tassel Sedge
Cyperaceae	Carex inversa	Knob Sedge
Cyperaceae	Carex longebrachiata	Bergalia Tussock
Cyperaceae	Carex spp.	
Cyperaceae	Caustis flexuosa	Curly Wig
Cyperaceae	Caustis pentandra	
Cyperaceae	Caustis recurvata	
Cyperaceae	Caustis recurvata var. hirsuta	
Cyperaceae	Caustis recurvata var. recurvata	
Cyperaceae	Caustis spp.	
Cyperaceae	Chorizandra cymbaria	
Cyperaceae	Chorizandra sphaerocephala	
Cyperaceae	Cyathochaeta diandra	
Cyperaceae	Eleocharis acuta	
Cyperaceae	Eleocharis sphacelata	Tall Spike Rush
Cyperaceae	Gahnia aspera	
Cyperaceae	Gahnia clarkei	
Cyperaceae	Gahnia erythrocarpa	
Cyperaceae	Gahnia melanocarpa	
Cyperaceae	Gahnia microstachya	
Cyperaceae	Gahnia radula	
Cyperaceae	Gahnia sieberiana	
Cyperaceae	Gahnia spp.	
Cyperaceae	Gymnoschoenus sphaerocephalus	

Family	Scientific Name	Common Name
Cyperaceae	Lepidosperma concavum	
Cyperaceae	Lepidosperma curtisiae	
Cyperaceae	Lepidosperma elatius	
Cyperaceae	Lepidosperma filiforme	
Cyperaceae	Lepidosperma forsythii	
Cyperaceae	Lepidosperma gunnii	
Cyperaceae	Lepidosperma laterale	
Cyperaceae	Lepidosperma limicola	
Cyperaceae	Lepidosperma longitudinale	
Cyperaceae	Lepidosperma neesii	
Cyperaceae	Lepidosperma spp.	
Cyperaceae	Lepidosperma tortuosum	
Cyperaceae	Lepidosperma urophorum	
Cyperaceae	Lepidosperma viscidum	
Cyperaceae	Ptilothrix deusta	
Cyperaceae	Schoenoplectus validus	
Cyperaceae	Schoenus apogon	Fluke Bogrush
Cyperaceae	Schoenus brevifolius	
Cyperaceae	Schoenus ericetorum	
Cyperaceae	Schoenus imberbis	
Cyperaceae	Schoenus lepidosperma subsp. pachylepis	
Cyperaceae	Schoenus melanostachys	
Cyperaceae	Schoenus turbinatus	
Cyperaceae	Tetraria capillaris	
Cyperaceae	Tricostularia pauciflora	
Davalliaceae	Arthropteris beckleri	
Davalliaceae	Arthropteris tenella	
Davalliaceae	Davallia solida var. pyxidata	Hare's Foot Fern
Dennstaedtiaceae	Dennstaedtia davallioides	Lacy Ground Fern
Dennstaedtiaceae	Histiopteris incisa	Bat's Wing Fern
Dennstaedtiaceae	Hypolepis muelleri	Harsh Ground Fern
Dennstaedtiaceae	Pteridium esculentum	Bracken
Dicksoniaceae	Calochlaena dubia	Common Ground Fern
Dicksoniaceae	Dicksonia antarctica	Soft Treefern
Dilleniaceae	Hibbertia acicularis	
Dilleniaceae	Hibbertia aspera subsp. aspera	
Dilleniaceae	Hibbertia bracteata	
Dilleniaceae	Hibbertia circumdans	

Family	Scientific Name	Common Name
Dilleniaceae	Hibbertia cistiflora subsp. cistiflora	
Dilleniaceae	Hibbertia dentata	Twining Guinea Flower
Dilleniaceae	Hibbertia diffusa	
Dilleniaceae	Hibbertia empetrifolia subsp. empetrifolia	
Dilleniaceae	Hibbertia fasciculata	
Dilleniaceae	Hibbertia linearis	
Dilleniaceae	Hibbertia monogyna	
Dilleniaceae	Hibbertia nitida	
Dilleniaceae	Hibbertia obtusifolia	
Dilleniaceae	Hibbertia riparia	
Dilleniaceae	Hibbertia rufa	
Dilleniaceae	Hibbertia scandens	Climbing Guinea Flower
Dilleniaceae	Hibbertia serpyllifolia	
Dilleniaceae	Hibbertia spp.	
Dilleniaceae	Hibbertia vestita	
Dilleniaceae	Hibbertia virgata subsp. virgata	
Doryanthaceae	Doryanthes excelsa	Gymea/Giant Lily
Droseraceae	Drosera auriculata	
Droseraceae	Drosera binata	
Droseraceae	Drosera peltata	
Droseraceae	Drosera spatulata	
Dryopteridaceae	Lastreopsis acuminata	Shiny Shield Fern
Dryopteridaceae	Lastreopsis decomposita	Trim Shield Fern
Dryopteridaceae	Lastreopsis microsora subsp. microsora	Creeping Shield Fern
Dryopteridaceae	Polystichum proliferum	Mother Shield Fern
Ebenaceae	Diospyros australis	Black Plum
Elaeocarpaceae	Elaeocarpus reticulatus	Blueberry Ash
Epacridaceae	Acrotriche divaricata	
Epacridaceae	Astroloma humifusum	Native Cranberry
Epacridaceae	Astroloma pinifolium	Pine Heath
Epacridaceae	Brachyloma daphnoides subsp. daphnoides	
Epacridaceae	Dracophyllum secundum	
Epacridaceae	Epacris calvertiana var. calvertiana	
Epacridaceae	Epacris crassifolia	
Epacridaceae	Epacris longiflora	Fuchsia Heath
Epacridaceae	Epacris microphylla var. microphylla	
Epacridaceae	Epacris obtusifolia	
Epacridaceae	Epacris pulchella	

Family	Scientific Name	Common Name
Epacridaceae	Epacris purpurascens	
Epacridaceae	Epacris purpurascens var. purpurascens	
Epacridaceae	Leucopogon amplexicaulis	
Epacridaceae	Leucopogon appressus	
Epacridaceae	Leucopogon ericoides	
Epacridaceae	Leucopogon esquamatus	
Epacridaceae	Leucopogon exolasius	
Epacridaceae	Leucopogon juniperinus	
Epacridaceae	Leucopogon lanceolatus var. lanceolatus	
Epacridaceae	Leucopogon microphyllus	
Epacridaceae	Leucopogon microphyllus var. microphyllus	
Epacridaceae	Leucopogon spp.	
Epacridaceae	Leucopogon virgatus	
Epacridaceae	Lissanthe sapida	Native Cranberry
Epacridaceae	Lissanthe strigosa	Peach Heath
Epacridaceae	Melichrus procumbens	Jam Tarts
Epacridaceae	Melichrus urceolatus	Urn Heath
Epacridaceae	Monotoca elliptica	
Epacridaceae	Monotoca ledifolia	
Epacridaceae	Monotoca scoparia	
Epacridaceae	Sprengelia incarnata	
Epacridaceae	Styphelia laeta	
Epacridaceae	Styphelia laeta subsp. laeta	
Epacridaceae	Styphelia triflora	
Epacridaceae	Styphelia tubiflora	
Epacridaceae	Styphelia viridis subsp. viridis	
Epacridaceae	Trochocarpa laurina	Tree Heath
Epacridaceae	Woollsia pungens	
Escalloniaceae	Polyosma cunninghamii	Featherwood
Escalloniaceae	Quintinia sieberi	Possumwood
Eucryphiaceae	Eucryphia moorei	Pinkwood
Euphorbiaceae	Amperea xiphoclada	
Euphorbiaceae	Amperea xiphoclada var. xiphoclada	
Euphorbiaceae	Bertya pomaderroides	
Euphorbiaceae	Breynia oblongifolia	Coffee Bush
Euphorbiaceae	Claoxylon australe	Brittlewood
Euphorbiaceae	Micrantheum ericoides	
Euphorbiaceae	Micrantheum hexandrum	

Family	Scientific Name	Common Name
Euphorbiaceae	Monotaxis linifolia	
Euphorbiaceae	Omalanthus populifolius	Bleeding Heart
Euphorbiaceae	Phyllanthus gunnii	
Euphorbiaceae	Phyllanthus hirtellus	
Euphorbiaceae	Phyllanthus tenellus	
Euphorbiaceae	Poranthera corymbosa	
Euphorbiaceae	Poranthera ericifolia	
Euphorbiaceae	Poranthera microphylla	
Euphorbiaceae	Pseudanthus orientalis	
Euphorbiaceae	Pseudanthus pimeleoides	
Euphorbiaceae	Ricinocarpos pinifolius	Wedding Bush
Fabaceae (Faboideae)	Almaleea paludosa	
Fabaceae (Faboideae)	Aotus ericoides	
Fabaceae (Faboideae)	Bossiaea buxifolia	
Fabaceae (Faboideae)	Bossiaea ensata	
Fabaceae (Faboideae)	Bossiaea heterophylla	
Fabaceae (Faboideae)	Bossiaea obcordata	
Fabaceae (Faboideae)	Bossiaea prostrata	
Fabaceae (Faboideae)	Bossiaea rhombifolia subsp. rhombifolia	
Fabaceae (Faboideae)	Bossiaea scolopendria	
Fabaceae (Faboideae)	Daviesia acicularis	
Fabaceae (Faboideae)	Daviesia alata	
Fabaceae (Faboideae)	Daviesia corymbosa	
Fabaceae (Faboideae)	Daviesia genistifolia	Broom Bitter Pea
Fabaceae (Faboideae)	Daviesia mimosoides subsp. mimosoides	
Fabaceae (Faboideae)	Daviesia squarrosa	
Fabaceae (Faboideae)	Daviesia ulicifolia	Gorse Bitter Pea
Fabaceae (Faboideae)	Desmodium rhytidophyllum	
Fabaceae (Faboideae)	Desmodium varians	Slender Tick-trefoil
Fabaceae (Faboideae)	Dillwynia brunioides	
Fabaceae (Faboideae)	Dillwynia elegans	
Fabaceae (Faboideae)	Dillwynia floribunda	
Fabaceae (Faboideae)	Dillwynia glaberrima	
Fabaceae (Faboideae)	Dillwynia parvifolia	
Fabaceae (Faboideae)	Dillwynia phylicoides	
Fabaceae (Faboideae)	Dillwynia ramosissima	
Fabaceae (Faboideae)	Dillwynia retorta	
Fabaceae (Faboideae)	Dillwynia sericea	

Family	Scientific Name	Common Name
Fabaceae (Faboideae)	Dillwynia spp.	
Fabaceae (Faboideae)	Glycine clandestina	
Fabaceae (Faboideae)	Glycine microphylla	
Fabaceae (Faboideae)	Glycine species A	
Fabaceae (Faboideae)	Glycine spp.	
Fabaceae (Faboideae)	Glycine tabacina	
Fabaceae (Faboideae)	Gompholobium glabratum	Dainty Wedge Pea
Fabaceae (Faboideae)	Gompholobium grandiflorum	Large Wedge Pea
Fabaceae (Faboideae)	Gompholobium huegelii	Pale Wedge Pea
Fabaceae (Faboideae)	Gompholobium latifolium	Golden Glory Pea
Fabaceae (Faboideae)	Gompholobium minus	Dwarf Wedge Pea
Fabaceae (Faboideae)	Gompholobium pinnatum	Pinnate Wedge Pea
Fabaceae (Faboideae)	Gompholobium virgatum	Leafy Wedge Pea
Fabaceae (Faboideae)	Gompholobium virgatum var. virgatum	
Fabaceae (Faboideae)	Hardenbergia violacea	False Sarsaparilla
Fabaceae (Faboideae)	Hovea linearis	
Fabaceae (Faboideae)	Hovea longifolia	
Fabaceae (Faboideae)	Hovea purpurea	
Fabaceae (Faboideae)	Indigofera australis	
Fabaceae (Faboideae)	Jacksonia scoparia	Dogwood
Fabaceae (Faboideae)	Kennedia prostrata	Running Postman
Fabaceae (Faboideae)	Kennedia rubicunda	Red Kennedy Pea
Fabaceae (Faboideae)	Mirbelia platylobioides	
Fabaceae (Faboideae)	Mirbelia rubiifolia	
Fabaceae (Faboideae)	Mirbelia speciosa subsp. speciosa	
Fabaceae (Faboideae)	Oxylobium cordifolium	Heart-leaved Shaggy Pea
Fabaceae (Faboideae)	Phyllota grandiflora	
Fabaceae (Faboideae)	Phyllota phylicoides	Heath Phyllota
Fabaceae (Faboideae)	Platylobium formosum	
Fabaceae (Faboideae)	Platylobium formosum subsp. parviflorum	
Fabaceae (Faboideae)	Podolobium ilicifolium	Prickly Shaggy Pea
Fabaceae (Faboideae)	Podolobium scandens	Netted Shaggy Pea
Fabaceae (Faboideae)	Pultenaea aristata	
Fabaceae (Faboideae)	Pultenaea blakelyi	
Fabaceae (Faboideae)	Pultenaea canescens	
Fabaceae (Faboideae)	Pultenaea daphnoides	
Fabaceae (Faboideae)	Pultenaea divaricata	
Fabaceae (Faboideae)	Pultenaea elliptica	

Family	Scientific Name	Common Name
Fabaceae (Faboideae)	Pultenaea flexilis	
Fabaceae (Faboideae)	Pultenaea glabra	
Fabaceae (Faboideae)	Pultenaea hispidula	
Fabaceae (Faboideae)	Pultenaea linophylla	
Fabaceae (Faboideae)	Pultenaea retusa	
Fabaceae (Faboideae)	Pultenaea scabra	
Fabaceae (Faboideae)	Pultenaea spp.	
Fabaceae (Faboideae)	Pultenaea stipularis	
Fabaceae (Faboideae)	Pultenaea villifera var. villifera	
Fabaceae (Faboideae)	Pultenaea villosa	
Fabaceae (Faboideae)	Sphaerolobium vimineum	
Fabaceae (Faboideae)	Viminaria juncea	Native Broom
Fabaceae (Mimosoideae)	Acacia binervata	Two-veined Hickory
Fabaceae (Mimosoideae)	Acacia binervia	Coast Myall
Fabaceae (Mimosoideae)	Acacia brownii	Heath Wattle
Fabaceae (Mimosoideae)	Acacia decurrens	Black Wattle
Fabaceae (Mimosoideae)	Acacia echinula	Hedgehog Wattle
Fabaceae (Mimosoideae)	Acacia elata	Mountain Cedar Wattle
Fabaceae (Mimosoideae)	Acacia elongata	Swamp Wattle
Fabaceae (Mimosoideae)	Acacia falciformis	Broad-leaved Hickory
Fabaceae (Mimosoideae)	Acacia floribunda	White Sally
Fabaceae (Mimosoideae)	Acacia hispidula	
Fabaceae (Mimosoideae)	Acacia implexa	Hickory Wattle
Fabaceae (Mimosoideae)	Acacia irrorata subsp. irrorata	Green Wattle
Fabaceae (Mimosoideae)	Acacia linifolia	Flax-leaved Wattle
Fabaceae (Mimosoideae)	Acacia longifolia	
Fabaceae (Mimosoideae)	Acacia longifolia subsp. longifolia	Sydney Golden Wattle
Fabaceae (Mimosoideae)	Acacia longissima	Narrow-leaved Wattle
Fabaceae (Mimosoideae)	Acacia maidenii	Maiden's Wattle
Fabaceae (Mimosoideae)	Acacia mearnsii	Black Wattle
Fabaceae (Mimosoideae)	Acacia melanoxylon	Blackwood
Fabaceae (Mimosoideae)	Acacia myrtifolia	Red-stemmed Wattle
Fabaceae (Mimosoideae)	Acacia obtusifolia	
Fabaceae (Mimosoideae)	Acacia parramattensis	Parramatta Wattle
Fabaceae (Mimosoideae)	Acacia parvipinnula	Silver-stemmed Wattle
Fabaceae (Mimosoideae)	Acacia rubida	Red-leaved Wattle
Fabaceae (Mimosoideae)	Acacia spp.	
Fabaceae (Mimosoideae)	Acacia stricta	Straight Wattle

Family	Scientific Name	Common Name
Fabaceae (Mimosoideae)	Acacia suaveolens	Sweet Wattle
Fabaceae (Mimosoideae)	Acacia terminalis	Sunshine Wattle
Fabaceae (Mimosoideae)	Acacia ulicifolia	Prickly Moses
Geraniaceae	Geranium homeanum	
Geraniaceae	Geranium potentilloides	
Geraniaceae	Geranium potentilloides var. potentilloides	
Geraniaceae	Geranium solanderi var. solanderi	
Geraniaceae	Pelargonium inodorum	
Gesneriaceae	Fieldia australis	
Gleicheniaceae	Gleichenia dicarpa	
Gleicheniaceae	Gleichenia microphylla	
Gleicheniaceae	Gleichenia rupestris	
Gleicheniaceae	Sticherus flabellatus var. flabellatus	Umbrella Fern
Gleicheniaceae	Sticherus lobatus	Spreading Shield Fern
Goodeniaceae	Dampiera purpurea	
Goodeniaceae	Dampiera stricta	
Goodeniaceae	Goodenia bellidifolia	
Goodeniaceae	Goodenia bellidifolia subsp. bellidifolia	
Goodeniaceae	Goodenia dimorpha	
Goodeniaceae	Goodenia dimorpha var. angustifolia	
Goodeniaceae	Goodenia dimorpha var. dimorpha	
Goodeniaceae	Goodenia hederacea subsp. hederacea	
Goodeniaceae	Goodenia hederacea subsp. hederacea	
Goodeniaceae	Goodenia heterophylla	
Goodeniaceae	Goodenia heterophylla subsp. heterophylla	
Goodeniaceae	Goodenia ovata	
Goodeniaceae	Goodenia spp.	
Goodeniaceae	Goodenia stelligera	
Goodeniaceae	Scaevola ramosissima	
Grammitaceae	Grammitis billardierei	Finger Fern
Haemodoraceae	Haemodorum corymbosum	
Haemodoraceae	Haemodorum planifolium	
Haloragaceae	Gonocarpus humilis	
Haloragaceae	Gonocarpus longifolius	
Haloragaceae	Gonocarpus micranthus	
Haloragaceae	Gonocarpus micranthus subsp. micranthus	
Haloragaceae	Gonocarpus micranthus subsp. ramosissimus	
Haloragaceae	Gonocarpus salsoloides	

Family	Scientific Name	Common Name
Haloragaceae	Gonocarpus spp.	
Haloragaceae	Gonocarpus tetragynus	
Haloragaceae	Gonocarpus teucrioides	
Hymenophyllaceae	Hymenophyllum cupressiforme	Common Filmy Fern
Hypoxidaceae	Hypoxis hygrometrica	Golden Weather-grass
Icacinaceae	Citronella moorei	Chumwood
Icacinaceae	Pennantia cunninghamii	Brown Beech
Iridaceae	Patersonia fragilis	
Iridaceae	Patersonia glabrata	
Iridaceae	Patersonia longifolia	
Iridaceae	Patersonia sericea	
Iridaceae	Patersonia spp.	
Juncaceae	Juncus bufonius	Toad Rush
Juncaceae	Juncus continuus	
Juncaceae	Juncus polyanthemus	
Juncaceae	Luzula flaccida	
Lamiaceae	Ajuga australis	Austral Bugle
Lamiaceae	Hemigenia purpurea	
Lamiaceae	Plectranthus parviflorus	
Lamiaceae	Prostanthera incana	Velvet Mint-bush
Lamiaceae	Prostanthera incisa	Cut-leaved Mint-bush
Lamiaceae	Prostanthera lasianthos	Victorian Christmas Bush
Lamiaceae	Prostanthera linearis	Narrow-leaved Mint-bush
Lamiaceae	Prostanthera rhombea	
Lamiaceae	Scutellaria humilis	Dwarf Skullcap
Lamiaceae	Westringia longifolia	
Lauraceae	Cassytha glabella forma glabella	
Lauraceae	Cassytha pubescens	
Lauraceae	Cassytha spp.	
Lauraceae	Cryptocarya glaucescens	Jackwood
Lauraceae	Cryptocarya microneura	Murrogun
Lauraceae	Endiandra sieberi	Hard Corkwood
Lentibulariaceae	Utricularia lateriflora	Small Bladderwort
Lindsaeaceae	Lindsaea linearis	Screw Fern
Lindsaeaceae	Lindsaea microphylla	Lacy Wedge Fern
Lobeliaceae	Lobelia dentata	
Lobeliaceae	Pratia purpurascens	Whiteroot
Loganiaceae	Logania albiflora	

Family	Scientific Name	Common Name
Loganiaceae	Logania pusilla	
Loganiaceae	Logania species A	
Loganiaceae	Mitrasacme paludosa	
Loganiaceae	Mitrasacme pilosa var. pilosa	
Loganiaceae	Mitrasacme polymorpha	
Loganiaceae	Mitrasacme spp.	
Lomandraceae	Lomandra brevis	
Lomandraceae	Lomandra confertifolia subsp. pallida	
Lomandraceae	Lomandra confertifolia subsp. rubiginosa	
Lomandraceae	Lomandra cylindrica	
Lomandraceae	Lomandra filiformis	Wattle Matt-rush
Lomandraceae	Lomandra filiformis subsp. coriacea	
Lomandraceae	Lomandra filiformis subsp. filiformis	
Lomandraceae	Lomandra filiformis subsp. filiformis	
Lomandraceae	Lomandra fluviatilis	
Lomandraceae	Lomandra glauca	Pale Mat-rush
Lomandraceae	Lomandra gracilis	
Lomandraceae	Lomandra longifolia	Spiny-headed Mat-rush
Lomandraceae	Lomandra micrantha subsp. tuberculata	Small-flowered Mat-rush
Lomandraceae	Lomandra multiflora subsp. multiflora	Many-flowered Mat-rush
Lomandraceae	Lomandra obliqua	
Lomandraceae	Lomandra spp.	
Loranthaceae	Amyema pendulum subsp. pendulum	
Loranthaceae	Muellerina celastroides	
Loranthaceae	Muellerina eucalyptoides	
Luzuriagaceae	Eustrephus latifolius	Wombat Berry
Luzuriagaceae	Geitonoplesium cymosum	Scrambling Lily
Lycopodiaceae	Lycopodiella cernua	Scrambling Clubmoss
Lycopodiaceae	Lycopodium deuterodensum	Bushy Clubmoss
Meliaceae	Synoum glandulosum subsp. glandulosum	Scentless Rosewood
Menispermaceae	Legnephora moorei	Round-leaf Vine
Menispermaceae	Sarcopetalum harveyanum	Pearl Vine
Menispermaceae	Stephania japonica	
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

Family	Scientific Name	Common Name
Myoporaceae	Myoporum acuminatum	
Myrsinaceae	Rapanea howittiana	Brush Muttonwood
Myrsinaceae	Rapanea variabilis	Muttonwood
Myrtaceae	Acmena smithii	Lilly Pilly
Myrtaceae	Angophora bakeri	Narrow-leaved Apple
Myrtaceae	Angophora costata	Sydney Red/Rusty Gum
Myrtaceae	Angophora floribunda	Rough-barked Apple
Myrtaceae	Angophora hispida	Dwarf Apple
Myrtaceae	Babingtonia densifolia	
Myrtaceae	Backhousia myrtifolia	Grey Myrtle
Myrtaceae	Baeckea brevifolia	
Myrtaceae	Baeckea diosmifolia	
Myrtaceae	Baeckea imbricata	
Myrtaceae	Baeckea linifolia	
Myrtaceae	Callistemon citrinus	Crimson Bottlebrush
Myrtaceae	Callistemon linearis	Narrow-leaved Bottlebrush
Myrtaceae	Callistemon pinifolius	Pine-leaved Bottlebrush
Myrtaceae	Callistemon rigidus	Stiff Bottlebrush
Myrtaceae	Callistemon spp.	
Myrtaceae	Calytrix tetragona	
Myrtaceae	Corymbia gummifera	Red Bloodwood
Myrtaceae	Darwinia biflora	
Myrtaceae	Darwinia diminuta	
Myrtaceae	Darwinia fascicularis subsp. fascicularis	
Myrtaceae	Darwinia grandiflora	
Myrtaceae	Darwinia leptantha	
Myrtaceae	Eucalyptus agglomerata	Blue-leaved Stringybark
Myrtaceae	Eucalyptus amplifolia subsp. amplifolia	
Myrtaceae	Eucalyptus apiculata	
Myrtaceae	Eucalyptus botryoides	Bangalay
Myrtaceae	Eucalyptus capitellata	Brown Stringybark
Myrtaceae	Eucalyptus consideniana	Yertchuk
Myrtaceae	Eucalyptus crebra	Narrow-leaved Ironbark
Myrtaceae	Eucalyptus cypellocarpa	Monkey Gum
Myrtaceae	Eucalyptus dives	Broad-leaved Peppermint
Myrtaceae	Eucalyptus elata	River Peppermint
Myrtaceae	Eucalyptus eugenioides	Thin-leaved Stringybark
Myrtaceae	Eucalyptus fastigata	Brown Barrel

Family	Scientific Name	Common Name
Myrtaceae	Eucalyptus fibrosa	Red Ironbark
Myrtaceae	Eucalyptus globoidea	White Stringybark
Myrtaceae	Eucalyptus haemastoma	Broad-leaved Scribbly Gum
Myrtaceae	Eucalyptus longifolia	Woollybutt
Myrtaceae	Eucalyptus luehmanniana	Yellow-top Ash
Myrtaceae	Eucalyptus moluccana	Grey Box
Myrtaceae	Eucalyptus muelleriana	Yellow Stringybark
Myrtaceae	Eucalyptus multicaulis	Whipstick Ash
Myrtaceae	Eucalyptus obliqua	Messmate
Myrtaceae	Eucalyptus oblonga	Stringybark
Myrtaceae	Eucalyptus ovata	Swamp Gum
Myrtaceae	Eucalyptus paniculata subsp. paniculata	
Myrtaceae	Eucalyptus pilularis	Blackbutt
Myrtaceae	Eucalyptus piperita	Sydney Peppermint
Myrtaceae	Eucalyptus punctata	Grey Gum
Myrtaceae	Eucalyptus quadrangulata	White-topped Box
Myrtaceae	Eucalyptus racemosa	Narrow-leaved Scribbly Gum
Myrtaceae	Eucalyptus radiata	Narrow-leaved Peppermint
Myrtaceae	Eucalyptus radiata subsp. radiata	
Myrtaceae	Eucalyptus saligna	Sydney Blue Gum
Myrtaceae	Eucalyptus saligna x botryoides	
Myrtaceae	Eucalyptus sclerophylla	Hard-leaved Scribbly Gum
Myrtaceae	Eucalyptus sieberi	Silvertop Ash
Myrtaceae	Eucalyptus smithii	Ironbark Peppermint
Myrtaceae	Eucalyptus sparsifolia	Narrow-leaved Stringybark
Myrtaceae	Eucalyptus spp.	
Myrtaceae	Eucalyptus stricta	Mallee Ash
Myrtaceae	Eucalyptus tereticornis	Forest Red Gum
Myrtaceae	Eucalyptus viminalis	Ribbon Gum
Myrtaceae	Euryomyrtus ramosissima subsp. ramosissima	
Myrtaceae	Kunzea ambigua	Tick Bush
Myrtaceae	Kunzea capitata	
Myrtaceae	Kunzea ericoides	Burgan
Myrtaceae	Leptospermum arachnoides	
Myrtaceae	Leptospermum continentale	Prickly Teatree
Myrtaceae	Leptospermum grandifolium	Woolly Teatree
Myrtaceae	Leptospermum juniperinum	
Myrtaceae	Leptospermum lanigerum	Woolly Teatree

Family	Scientific Name	Common Name
Myrtaceae	Leptospermum morrisonii	
Myrtaceae	Leptospermum parvifolium	
Myrtaceae	Leptospermum polygalifolium	
Myrtaceae	Leptospermum polygalifolium subsp. polygalifolium	
Myrtaceae	Leptospermum rotundifolium	
Myrtaceae	Leptospermum sphaerocarpum	
Myrtaceae	Leptospermum spp.	
Myrtaceae	Leptospermum squarrosum	
Myrtaceae	Leptospermum trinervium	
Myrtaceae	Melaleuca decora	
Myrtaceae	Melaleuca hypericifolia	
Myrtaceae	Melaleuca linariifolia	
Myrtaceae	Melaleuca squamea	
Myrtaceae	Melaleuca squarrosa	
Myrtaceae	Melaleuca styphelioides	Prickly-leaved Tea-tree
Myrtaceae	Melaleuca thymifolia	
Myrtaceae	Micromyrtus ciliata	
Myrtaceae	Rhodamnia rubescens	Scrub Turpentine
Myrtaceae	Syncarpia glomulifera subsp. glomulifera	
Myrtaceae	Tristania neriifolia	Water Gum
Myrtaceae	Tristaniopsis collina	Mountain Water Gum
Myrtaceae	Tristaniopsis laurina	Kanuka
Olacaceae	Olax stricta	
Oleaceae	Ligustrum sinense	Small-leaved Privet
Oleaceae	Notelaea longifolia	Large Mock-olive
Oleaceae	Notelaea longifolia forma longifolia	
Oleaceae	Notelaea microcarpa	Native Olive
Oleaceae	Notelaea ovata	
Oleaceae	Notelaea venosa	Veined Mock-olive
Ophioglossaceae	Ophioglossum lusitanicum	Adder's Tongue
Orchidaceae	Acianthus exsertus	Mosquito Orchid
Orchidaceae	Acianthus fornicatus	Pixie Caps
Orchidaceae	Acianthus spp.	
Orchidaceae	Arthrochilus prolixus	
Orchidaceae	Bulbophyllum exiguum	
Orchidaceae	Caladenia catenata	White Caladenia
Orchidaceae	Caleana major	Large Duck Orchid
Orchidaceae	Caleana minor	Small Duck Orchid

Family	Scientific Name	Common Name
Orchidaceae	Chiloglottis reflexa	
Orchidaceae	Chiloglottis spp.	
Orchidaceae	Corybas spp.	
Orchidaceae	Cryptostylis erecta	Tartan Tongue Orchid
Orchidaceae	Cryptostylis spp.	
Orchidaceae	Cryptostylis subulata	Large Tongue Orchid
Orchidaceae	Cymbidium suave	Snake Orchid
Orchidaceae	Dendrobium linguiforme	Tongue Orchid
Orchidaceae	Dendrobium pugioniforme	Dagger Orchid
Orchidaceae	Dendrobium speciosum	Rock Lily
Orchidaceae	Dipodium punctatum	
Orchidaceae	Dipodium variegatum	
Orchidaceae	Genoplesium filiforme	
Orchidaceae	Glossodia minor	Small Waxlip Orchid
Orchidaceae	Liparis reflexa	
Orchidaceae	Microtis unifolia	Common Onion Orchid
Orchidaceae	Orthoceras strictum	Horned/Bird's-mouth Orchid
Orchidaceae	Prasophyllum brevilabre	Short-lipped Leek Orchid
Orchidaceae	Pterostylis curta	Blunt Greenhood
Orchidaceae	Pterostylis grandiflora	Cobra Greenhood
Orchidaceae	Pterostylis longifolia	Tall Greenhood
Orchidaceae	Pterostylis nutans	Nodding Greenhood
Orchidaceae	Pterostylis parviflora	Tiny Greenhood
Orchidaceae	Pterostylis reflexa	
Orchidaceae	Pterostylis spp.	
Orchidaceae	Pyrorchis nigricans	
Orchidaceae	Sarcochilus australis	Butterfly Orchid
Orchidaceae	Sarcochilus falcatus	Orange Blossom Orchid
Orchidaceae	Spiranthes sinensis subsp. australis	Ladies Tresses
Orchidaceae	Thelymitra circumsepta	Naked Sun Orchid
Orchidaceae	Thelymitra ixioides var. ixioides	Dotted Sun Orchid
Orchidaceae	Thelymitra venosa	Large Veined Sun Orchid
Osmundaceae	Todea barbara	King Fern
Oxalidaceae	Oxalis chnoodes	
Oxalidaceae	Oxalis exilis	
Oxalidaceae	Oxalis perennans	
Passifloraceae	Passiflora herbertiana subsp. herbertiana	Native Passionfruit
Phormiaceae	Dianella caerulea	

Family	Scientific Name	Common Name
Phormiaceae	Dianella caerulea var. caerulea	
Phormiaceae	Dianella caerulea var. producta	
Phormiaceae	Dianella longifolia	
Phormiaceae	Dianella longifolia var. longifolia	
Phormiaceae	Dianella revoluta var. revoluta	
Phormiaceae	Dianella spp.	
Phormiaceae	Dianella tasmanica	
Phormiaceae	Thelionema caespitosum	
Phormiaceae	Thelionema umbellatum	
Phytolaccaceae	Phytolacca octandra	Inkweed
Pittosporaceae	Billardiera scandens	Appleberry
Pittosporaceae	Billardiera scandens var. scandens	
Pittosporaceae	Billardiera scandens var. sericata	
Pittosporaceae	Bursaria spinosa	Native Blackthorn
Pittosporaceae	Bursaria spinosa subsp. spinosa	
Pittosporaceae	Pittosporum multiflorum	Orange Thorn
Pittosporaceae	Pittosporum multiflorum	Orange Thorn
Pittosporaceae	Pittosporum revolutum	Rough Fruit Pittosporum
Pittosporaceae	Pittosporum undulatum	Sweet Pittosporum
Plantaginaceae	Plantago lanceolata	Lamb's Tongues
Plantaginaceae	Plantago varia	
Poaceae	Agrostis avenacea var. avenacea	
Poaceae	Amphibromus nervosus	
Poaceae	Amphipogon strictus var. strictus	Greybeard Grass
Poaceae	Andropogon virginicus	Whisky Grass
Poaceae	Anisopogon avenaceus	Oat Speargrass
Poaceae	Aristida ramosa	
Poaceae	Aristida ramosa var. ramosa	
Poaceae	Aristida ramosa var. scaberula	
Poaceae	Aristida vagans	Threeawn Speargrass
Poaceae	Aristida warburgii	
Poaceae	Austrodanthonia pilosa	Smooth-flowered Wallaby Grass
Poaceae	Austrodanthonia tenuior	
Poaceae	Austrostipa pubescens	
Poaceae	Austrostipa pubescens	
Poaceae	Austrostipa rudis subsp. nervosa	
Poaceae	Austrostipa spp.	
Poaceae	Austrostipa verticillata	

Family	Scientific Name	Common Name
Poaceae	Chloris spp.	
Poaceae	Cymbopogon refractus	Barbed Wire Grass
Poaceae	Cynodon dactylon	Common Couch
Poaceae	Deyeuxia decipiens	
Poaceae	Dichelachne crinita	Longhair Plumegrass
Poaceae	Dichelachne micrantha	Shorthair Plumegrass
Poaceae	Dichelachne parva	
Poaceae	Dichelachne rara	
Poaceae	Echinopogon caespitosus var. caespitosus	Tufted Hedgehog Grass
Poaceae	Echinopogon ovatus	Forest Hedgehog Grass
Poaceae	Entolasia marginata	Bordered Panic
Poaceae	Entolasia spp.	
Poaceae	Entolasia stricta	Wiry Panic
Poaceae	Eragrostis brownii	Brown's Lovegrass
Poaceae	Imperata cylindrica var. major	Blady Grass
Poaceae	Joycea pallida	Silvertop Wallaby Grass
Poaceae	Microlaena stipoides	
Poaceae	Microlaena stipoides var. stipoides	
Poaceae	Notodanthonia longifolia	Long-leaved Wallaby Grass
Poaceae	Oplismenus aemulus	
Poaceae	Oplismenus imbecillis	
Poaceae	Paspalidium distans	
Poaceae	Paspalidium spp.	
Poaceae	Paspalum spp.	
Poaceae	Phragmites australis	Common Reed
Poaceae	Plinthanthesis paradoxa	
Poaceae	Poa affinis	
Poaceae	Poa labillardierei var. labillardierei	Tussock
Poaceae	Poa pratensis	Kentucky Bluegrass
Poaceae	Poa sieberiana	
Poaceae	Poa spp.	
Poaceae	Stipa spp.	
Poaceae	Tetrarrhena juncea	Wiry Ricegrass
Poaceae	Tetrarrhena turfosa	
Poaceae	Themeda australis	Kangaroo Grass
Podocarpaceae	Podocarpus elatus	Plum Pine
Polygalaceae	Comesperma ericinum	
Polygalaceae	Comesperma sphaerocarpum	

Family	Scientific Name	Common Name
Polygalaceae	Comesperma volubile	
Polypodiaceae	Microsorum pustulatum	Kangaroo Fern
Polypodiaceae	Microsorum scandens	Fragrant Fern
Polypodiaceae	Platycerium bifurcatum	Elkhorn
Polypodiaceae	Pyrrosia rupestris	Rock Felt Fern
Proteaceae	Banksia cunninghamii subsp. cunninghamii	
Proteaceae	Banksia ericifolia subsp. ericifolia	
Proteaceae	Banksia marginata	
Proteaceae	Banksia oblongifolia	
Proteaceae	Banksia paludosa	
Proteaceae	Banksia paludosa subsp. paludosa	
Proteaceae	Banksia robur	
Proteaceae	Banksia serrata	
Proteaceae	Banksia spinulosa	
Proteaceae	Banksia spinulosa var. spinulosa	
Proteaceae	Conospermum ellipticum	
Proteaceae	Conospermum longifolium	
Proteaceae	Conospermum longifolium subsp. angustifolium	
Proteaceae	Conospermum longifolium subsp. longifolium	
Proteaceae	Conospermum taxifolium	
Proteaceae	Conospermum tenuifolium	
Proteaceae	Grevillea arenaria subsp. arenaria	
Proteaceae	Grevillea baueri subsp. baueri	
Proteaceae	Grevillea buxifolia	Grey Spider Flower
Proteaceae	Grevillea diffusa	
Proteaceae	Grevillea diffusa subsp. diffusa	
Proteaceae	Grevillea linearifolia	
Proteaceae	Grevillea longifolia	
Proteaceae	Grevillea mucronulata	
Proteaceae	Grevillea oleoides	
Proteaceae	Grevillea parviflora	
Proteaceae	Grevillea patulifolia	
Proteaceae	Grevillea phylicoides	
Proteaceae	Grevillea sericea	
Proteaceae	Grevillea sphacelata	
Proteaceae	Grevillea spp.	
Proteaceae	Grevillea triternata	
Proteaceae	Hakea bakeriana	

Family	Scientific Name	Common Name
Proteaceae	Hakea dactyloides	
Proteaceae	Hakea gibbosa	
Proteaceae	Hakea laevipes subsp. laevipes	
Proteaceae	Hakea salicifolia	Willow-leaved Hakea
Proteaceae	Hakea sericea	
Proteaceae	Hakea teretifolia	
Proteaceae	Isopogon anemonifolius	
Proteaceae	Isopogon anethifolius	
Proteaceae	Lambertia formosa	Mountain Devil
Proteaceae	Lomatia ilicifolia	
Proteaceae	Lomatia myricoides	River Lomatia
Proteaceae	Lomatia silaifolia	Crinkle Bush
Proteaceae	Persoonia glaucescens	
Proteaceae	Persoonia lanceolata	
Proteaceae	Persoonia laurina	
Proteaceae	Persoonia laurina subsp. intermedia	
Proteaceae	Persoonia levis	Broad-leaved Geebung
Proteaceae	Persoonia linearis	Narrow-leaved Geebung
Proteaceae	Persoonia mollis	
Proteaceae	Persoonia mollis subsp. ledifolia	
Proteaceae	Persoonia mollis subsp. maxima	
Proteaceae	Persoonia mollis subsp. mollis	
Proteaceae	Persoonia mollis subsp. nectens	
Proteaceae	Persoonia oblongata	
Proteaceae	Persoonia pinifolia	Pine-leaved Geebung
Proteaceae	Persoonia spp.	
Proteaceae	Petrophile canescens	
Proteaceae	Petrophile pedunculata	
Proteaceae	Petrophile pulchella	
Proteaceae	Petrophile sessilis	
Proteaceae	Stenocarpus salignus	Scrub Beefwood
Proteaceae	Symphionema montanum	
Proteaceae	Symphionema paludosum	
Proteaceae	Telopea speciosissima	Waratah
Proteaceae	Xylomelum pyriforme	
Psilotaceae	Tmesipteris truncata	
Pteridaceae	Pteris tremula	Tender Brake
Pteridaceae	Pteris umbrosa	Jungle Brake

Family	Scientific Name	Common Name
Ranunculaceae	Clematis aristata	
Ranunculaceae	Clematis glycinoides	Headache Vine
Ranunculaceae	Clematis glycinoides var. glycinoides	
Restionaceae	Baloskion gracile	
Restionaceae	Baloskion tetraphyllum subsp. meiostachyum	
Restionaceae	Empodisma minus	
Restionaceae	Eurychorda complanata	
Restionaceae	Guringalia dimorpha	
Restionaceae	Hypolaena fastigiata	
Restionaceae	Leptocarpus tenax	
Restionaceae	Lepyrodia anarthria	
Restionaceae	Lepyrodia muelleri	
Restionaceae	Lepyrodia scariosa	
Restionaceae	Saropsis fastigiata	
Restionaceae	Sporadanthus gracilis	
Rhamnaceae	Alphitonia excelsa	Red Ash
Rhamnaceae	Cryptandra ericoides	
Rhamnaceae	Cryptandra propinqua	
Rhamnaceae	Cryptandra spinescens	
Rhamnaceae	Pomaderris andromedifolia	
Rhamnaceae	Pomaderris aspera	Hazel Pomaderris
Rhamnaceae	Pomaderris elliptica subsp. elliptica	
Rhamnaceae	Pomaderris ferruginea	
Rhamnaceae	Pomaderris intermedia	
Rhamnaceae	Pomaderris lanigera	
Rhamnaceae	Pomaderris spp.	
Rosaceae	Acaena novae-zelandiae	
Rosaceae	Rubus discolor	Blackberry
Rosaceae	Rubus fruiticosus	Blackberry complex
Rosaceae	Rubus moluccanus var. trilobus	Molucca Bramble
Rosaceae	Rubus nebulosus	Green-leaved Bramble
Rosaceae	Rubus parvifolius	Native Raspberry
Rosaceae	Rubus rosifolius	Rose-leaf Bramble
Rosaceae	Rubus ulmifolius	Blackberry
Rubiaceae	Asperula conferta	Common Woodruff
Rubiaceae	Asperula spp.	
Rubiaceae	Canthium coprosmoides	Coast Canthium
Rubiaceae	Coprosma quadrifida	Prickly Currant Bush

Family	Scientific Name	Common Name
Rubiaceae	Galium binifolium	
Rubiaceae	Galium gaudichaudii	Rough Bedstraw
Rubiaceae	Galium propinquum	Maori Bedstraw
Rubiaceae	Morinda jasminoides	
Rubiaceae	Nertera granadensis	
Rubiaceae	Opercularia aspera	Coarse Stinkweed
Rubiaceae	Opercularia diphylla	
Rubiaceae	Opercularia hispida	Hairy Stinkweed
Rubiaceae	Opercularia varia	Variable Stinkweed
Rubiaceae	Pomax umbellata	
Rubiaceae	Psychotria loniceroides	Hairy Psychotria
Rutaceae	Acronychia oblongifolia	Common Acronychia
Rutaceae	Boronia anemonifolia var. anemonifolia	
Rutaceae	Boronia anethifolia	
Rutaceae	Boronia fraseri	
Rutaceae	Boronia ledifolia	Sydney Boronia
Rutaceae	Boronia parviflora	Swamp Boronia
Rutaceae	Boronia pinnata	
Rutaceae	Boronia polygalifolia	
Rutaceae	Boronia serrulata	Rose Boronia
Rutaceae	Correa reflexa	Native Fuschia
Rutaceae	Correa reflexa var. reflexa	Native Fuschia
Rutaceae	Crowea saligna	
Rutaceae	Eriostemon australasius	
Rutaceae	Geijera salicifolia var. latifolia	
Rutaceae	Leionema coxii	
Rutaceae	Leionema dentatum	Toothed Phebalium
Rutaceae	Nematolepis squamea subsp. squamea	Satinwood
Rutaceae	Phebalium diosmeum	
Rutaceae	Phebalium squamulosum	Scaly Phebalium
Rutaceae	Phebalium squamulosum subsp. squamulosum	
Rutaceae	Philotheca buxifolia	
Rutaceae	Philotheca hispidula	
Rutaceae	Philotheca myoporoides subsp. myoporoides	
Rutaceae	Philotheca salsolifolia subsp. salsolifolia	
Rutaceae	Philotheca scabra subsp. scabra	
Rutaceae	Zieria caducibracteata	
Rutaceae	Zieria cytisoides	Downy Zieria

Family	Scientific Name	Common Name
Rutaceae	Zieria laevigata	
Rutaceae	Zieria pilosa	
Rutaceae	Zieria smithii	Sandfly Zieria
Rutaceae	Zieria spp.	
Sambucaceae	Sambucus australasica	Native Elderberry
Sambucaceae	Sambucus spp.	
Santalaceae	Choretrum candollei	White Sour Bush
Santalaceae	Choretrum pauciflorum	Dwarf Sour Bush
Santalaceae	Choretrum species A	
Santalaceae	Exocarpos cupressiformis	Native Cherry
Santalaceae	Exocarpos strictus	Dwarf Cherry
Santalaceae	Leptomeria acida	Sour Currant Bush
Santalaceae	Omphacomeria acerba	
Santalaceae	Santalum obtusifolium	Sandalwood
Sapindaceae	Alectryon subcinereus	Wild Quince
Sapindaceae	Diploglottis australis	Native Tamarind
Sapindaceae	Dodonaea camfieldii	
Sapindaceae	Dodonaea triquetra	
Sapindaceae	Dodonaea viscosa subsp. angustifolia	
Schizaeaceae	Schizaea bifida	Forked Comb Fern
Schizaeaceae	Schizaea dichotoma	Branched Comb Fern
Scrophulariaceae	Kickxia elatine subsp. crinita	Twining Toadflax
Scrophulariaceae	Veronica calycina	Hairy Speedwell
Scrophulariaceae	Veronica plebeia	Trailing Speedwell
Selaginellaceae	Selaginella uliginosa	
Smilacaceae	Smilax australis	Sarsaparilla
Smilacaceae	Smilax glyciphylla	Sweet Sarsparilla
Smilacaceae	Smilax spp.	
Solanaceae	Duboisia myoporoides	Corkwood
Solanaceae	Solanum mauritianum	Wild Tobacco Bush
Solanaceae	Solanum prinophyllum	Forest Nightshade
Solanaceae	Solanum pungetium	Eastern Nightshade
Solanaceae	Solanum stelligerum	Devil's Needles
Stackhousiaceae	Stackhousia nuda	
Stackhousiaceae	Stackhousia spp.	
Stackhousiaceae	Stackhousia viminea	Slender Stackhousia
Sterculiaceae	Brachychiton acerifolius	Illawarra Flame Tree
Sterculiaceae	Commersonia fraseri	Brush Kurrajong

Family	Scientific Name	Common Name
Sterculiaceae	Lasiopetalum ferrugineum	
Sterculiaceae	Lasiopetalum ferrugineum var. cordatum	
Sterculiaceae	Lasiopetalum ferrugineum var. ferrugineum	
Stylidiaceae	Stylidium graminifolium	Grass Triggerplant
Stylidiaceae	Stylidium laricifolium	Tree Triggerplant
Stylidiaceae	Stylidium lineare	Narrow-leaved Triggerplant
Stylidiaceae	Stylidium productum	
Stylidiaceae	Stylidium spp.	
Symplocaceae	Symplocos thwaitesii	Buff Hazelwood
Thymelaeaceae	Pimelea glauca	
Thymelaeaceae	Pimelea ligustrina	
Thymelaeaceae	Pimelea ligustrina subsp. hypericina	
Thymelaeaceae	Pimelea ligustrina subsp. ligustrina	
Thymelaeaceae	Pimelea linifolia	
Thymelaeaceae	Pimelea linifolia subsp. collina	
Thymelaeaceae	Pimelea linifolia subsp. linifolia	
Tremandraceae	Tetratheca ericifolia	
Tremandraceae	Tetratheca neglecta	
Tremandraceae	Tetratheca shiressii	
Tremandraceae	Tetratheca spp.	
Tremandraceae	Tetratheca thymifolia	Black-eyed Susan
Urticaceae	Australina pusilla	
Urticaceae	Elatostema reticulatum	
Urticaceae	Urtica incisa	Stinging Nettle
Uvulariaceae	Schelhammera undulata	
Verbenaceae	Clerodendrum tomentosum	
Verbenaceae	Lantana camara	Lantana
Violaceae	Hybanthus monopetalus	Slender Violet-bush
Violaceae	Hybanthus vernonii	
Violaceae	Hymenanthera dentata	Tree Violet
Violaceae	Viola betonicifolia	
Violaceae	Viola hederacea	Ivy-leaved Violet
Violaceae	Viola hederacea forma A	
Violaceae	Viola hederacea forma B	
Violaceae	Viola hederacea forma D	
Violaceae	Viola hederacea forma F	
Violaceae	Viola odorata	Sweet Violet
Violaceae	Viola sieberiana	

Family	Scientific Name	Common Name
Viscaceae	Notothixos subaureus	Golden Mistletoe
Vitaceae	Cissus hypoglauca	Giant Water Vine
Winteraceae	Tasmannia insipida	Brush Pepperwood
Xanthorrhoeaceae	Xanthorrhoea arborea	
Xanthorrhoeaceae	Xanthorrhoea australis	
Xanthorrhoeaceae	Xanthorrhoea concava	
Xanthorrhoeaceae	Xanthorrhoea media	
Xanthorrhoeaceae	Xanthorrhoea minor subsp. minor	
Xanthorrhoeaceae	Xanthorrhoea resinifera	
Xyridaceae	Xyris bracteata	
Xyridaceae	Xyris complanata	
Xyridaceae	Xyris gracilis	
Xyridaceae	Xyris juncea	
Xyridaceae	Xyris operculata	
Xyridaceae	Xyris ustulata	

APPENDIX D: API CODES FOR CANOPY SPECIES AND STRUCTURAL TYPES.

API Code	*Name*	*Dominant Species*	*Other Species Present*	*Vegetation Structure*	*Where*
RAINFORESTS					
R1	*Dry Rainforest-Simple*	*Backhousia myrtifolia*	*Tristania laurina, Ceratopetalum apetalum*	Closed Forest	Dry but well structured Creeklines, central and western plateau and fire affected gullies
R1a	*Riparian Scrubs*	*Ceratopetalum, Backhousia myrtifolia, Tristania laurina*	*Sticherus, Gleichenia*	Closed scrub	Low Height, generally on deeper Hawkesbury Gullies, O'Hares and Woronora
R1b	*Riparian Scrubs*	*Casuarina cunninghamiana, Tristaniopsis, Leptospermum polygalifolium*		Closed scrub	Flood Zone of Western Cataract, Bargo, Avon and Nepean Gorges
R6	*Warm Temperate – Subtropical Rainforest*	*Doryphora sassafras, Toona australis, Dendrocnide excelsa*	*Elaeocarpus kirtonii, Ficus* spp., *Livistona australis, Pennantia cunninghamii*	Closed forest - large emergent trees, vines, ferns , no tree ferns, up to 20 dominant tree species	Cordeaux catchment on Crinanite Only, Wattle Creek. Subtropical Rainforest elements occur on soils derived from latite, on benches on the escarpment (which are latite bands within Illawarra coal measures) and in low altitude gully bottoms (Macquarie pass) - structure closed 10 - 30m h
R7	*Warm Temperate Rainforest*	*Ceratopetalum apetalum, Acmena smithii, Doryphora sassafras*	*Diploglottis australis, Schizomeria ovata, Cryptocarya glaucescens, Pararchidendron pruinosum* var. *pruinosum, Trochocarpa laurina, Tasmannia insipida*	Closed forest - structurally and floristically less diverse than ST, 3-4 tree spp, tree ferns and ground ferns common.	Cordeaux Catchment, Bulli, Wombarra, Mt. Kembla - found in gullies along creek lines and in other sheltered areas protected by escarpment cliffs, on sandstone talus slopes or sandstones of Illawarra coal measures - soils generally texture contra
R8	*High Elevation Mixed Warm Temperate/Cool Temperate*	*Eucryphia moorei, Ceratopetalum apetalum*	*Acmena smithii, Doryphora sassafras, Dicksonia antarctica, Quintinia sieberi, Cyathea leichhardtiana, Polyosma cunninghamii*	Closed forest - tree ferns and mosses common understorey features	Loddon Falls, Cataract Catchment, Bong Bong Pass, West Dapto, Barren Grounds, basaltic Robertson plateau - structure 10 - 20m trees but sometimes dwarfed in exposed situations (Macquarie Pass) - Usually 3-4 dominant species, ferns and mosses very common
R9	*Regenerating Turpentine Stand*	*Syncarpia glomulifera*		Monospecific stands of Turpentine	Cataract, Cordeaux

API Code	Name	Dominant Species	Other Species Present	Vegetation Structure	Where
RE7	*Warm Temperate Rainforest with Emergents*	*Syncarpia glomulifera, Eucalyptus pilularis , E. saligna x botryoides*	*Ceratopetalum apetalum, Diploglottis australis, Acmena smithii, Schizomeria ovata, Cryptocarya glaucescens, Pararchidendron pruinosum* var. *pruinosum*	Tall open forest with closed forest understorey	Classification will allow for up to 30% Eucalypts in Canopy
RE8	*Hgh Elevation Mixed Warm Temperate/ Cool Temperate with Emergents*	*Eucalyptus smithii, E. cypellocarpa, E. elata, Syncarpia glomulifera, E. fastigata, E. muelleriana*	*Ceratopetalum apetalum, Eucryphia moorei, Acmena smithii, Doryphora sassafras*	Tall open forest with closed forest understorey	Classification will allow for up to 30% Eucalypts in Canopy. Upper escarpment , south from Mt. Keira
TALL OPEN FORESTS AND OPEN FORESTS					
E1	*White Box*	*Eucalyptus quadrangulata*		Open Forest - Tall open forest mesic understorey	Occurs on Crinanite in Cordeaux Catchment - Wattle Creek - Woronora Plateau
E2a	*Grassy Version?*				
SHALE AND OTHER TRANSITIONAL FORESTS					
E9g	*O'Hares Shale Forest*	*Angophora costata, Eucalyptus piperita, Corymbia gummifera, E. globoidea*		Open forest with shrub understorey	Darkes Forest, Maddens Plains – understorey not described - NCC
E9a	*Bargo Brush*	*Eucalyptus crebra, E. globoidea, E. punctata*	Sometimes *E. paniculata*		Western extent of plateau, Bargo area
E9b	*Bargo Brush #2*	*Eucalyptus crebra, E. moluccana, E. punctata,E. globoidea*	Sometimes *Acacia longifolia*		
E9c	*Pilularis Shale Cap*	*Eucalyptus pilularis*		Open Grassy	On Picton Road near Cordeaux Dam turnoff
E9d	*Shale BlueGgum*	*Eucalyptus botryoides, E. saligna*		Open Grassy	Bulli Map Sheet
E9e	*Plateau Shale Red Gum forest*	*Eucalyptus amplifolia, E. tereticornis*		Open Grassy	Tiny Patch Cordeaux Catchment.. Large remnants on floodplains near Mittagong, South from Alpine
E9f	*Central Plateau Shale*	*Eucalyptus crebra, E. cypellocarpa, E. punctata, E. globoidea*			

API Code	Name	Dominant Species	Other Species Present	Vegetation Structure	Where
E9h	*Sandstone Shale Low Open Forest*	*Eucalyptus sclerophylla, E. punctata, E. globoidea*		Sandstone/Grassy understorey	Driven by presence of Grey Gum amongst a typical sandstone ridgetop woodland, represents a gradation between residual shales and sandstones, Found at end of long plateaux south of Picton Road and Nepean River.
E9i	*Peppermint Eye Forest*	*Eucalyptus piperata*	*Calochlaena, Pteridium*		One golden eye
E9p	*Peppermint Shale Bench Forest*	*Eucalyptus piperata*			
E9q	*Mittagong Moist Grassy Shale Forest*	*Eucalyptus quadrangulata, E. eugenioides, E. punctata, E. elata* Sometimes *E. cypellocarpa*		Grassy to low moist shrubby	South Western High elevation Shales. Tall Forest
E9r	*Cumberland Plain Woodland*	*Eucalyptus tereticornis, E. moluccana/E. crebra*			
E9s	*Stringybark Shale Residual Forest*	*Eucalyptus globoidea, E. piperata, Corymbia gummifera*		Grassy to Shrubby	Usually indicates lesser shale influence, forming a Halo around the eye of the rich shale or basalt soils. Not as tall or well developed
E9t#	*Peppermint Trachyte Forest*	*Eucalyptus piperata*			Near Mt. Cotopaxi on Trachyte Rocks
E50	*Tall Cordeaux Seam Forest*	*Eucalyptus quadrangulata, E. elata, E. globoidea*		Grassy to Shrubby	9s stringybarks dominating on exposed slopes
Plateau Sandstone Forests					
E10	*Scribbly Gum - Silvertop Ash*	*Eucalyptus sieber , E. smithi , E. piperita, E. ligustrina, E. racemosa, E. dendromorpha*	*Leucopogon juniperinus, Leptospermum* spp., *Acacia obtusifolia, Banksia spinulosa, Pultenaea blakelyi, Pteridium esculentum, Lomandra* spp.	Open forest with shrub understorey	above Macquarie Pass community 3
E10a	*Low Open Scribbly Gum Woodland*	*Eucalyptus sclerophylla*		above a moist heath or moist sedge understorey	Low Open forest <25% ccp, generally adjoining H8 swamps but can occur over rocky pavement heaths
E10g	*Low Open Scribbly Gum Woodland South Western Form*	*Eucalyptus sclerophylla, E. mannifera*			As above in the south west of the Study Area

API Code	Name	Dominant Species	Other Species Present	Vegetation Structure	Where
E13	*Blue Gum Hybrid TallOpen Forest*	*Eucalyptus saligna , E. quadrangulata*		Open forest with shrub understorey	Cordeaux Heights near Figtree
E13a	*Pure Blue Gum Tall Open Forest*				
E15	*Blackbutt Forest*	*Eucalyptus pilularis , E. saligna x botryoides, E. paniculata, Angophora floribunda, Syncarpia glomulifera*	*Acacia binervata*, *Allocasuarina torulosa*, *Indigofera australis, Persoonia linearis, Imperata cylindrica, Pteridium esculentum, Oxylobium ilicifolium*	Tall open forest	,Helensburgh, escarpment slopes extending from below sandstone cliffs to floodplain on north side of Mt. Kembla and between 130m and 320m on southern - (also map unit 6i Benson and Howell, 1994)
E15c	*Blackbutt-Angophora Sheltered Forest*	*Eucalyptus pilularis, Angophora costata*		Tall open Forest	Eastern Woronora Gullies, maybe some western gullies in Cataract?
E15d	*Blackbutt Plateau*	*Eucalyptus pilularis, E. piperata, E. cypellocarpa*		Tall Open Forest	Higher elevations, Cataract Catchment, very grassy open understorey
E16	*Mixed Tall Mountain Forest*	*Eucalyptus muelleriana, E. smithii, E. quadrangulata*	*Allocasuarina torulosa, Oxylobium ilicifolium*	Tall open forest with shrub understorey	(Macquarie Pass - comm 7) this occurs on Coalcliff sandstone
E16a	*Gully Gum Tall Forest*	*Eucalyptus smithii*			
E16b	*Yellow Stringybark Tall Forest*				
E16c	*River Peppermint Tall Forest*				
E16d	*Mixed Tall Mountain Forest with Blue Gum*				
E16e	*Messmate, Mountain Grey Gum, Narrow-leaved Peppermint*	*Eucalyptus obliqua, E. cypellocarpa, E. piperata, E. radiata*			High Rainfall, High elevation shales in the south fringing Basalt geology
E17	*Plateau Mallee Heath*				
E17a	*Budawang Ash Forest*				
E20	*Silvertop Ash Tall Forest*				
E20a	*Silvertop Ash Transition Forest*	*Eucalyptus sieberi, E. piperata*			Shale sandstone forest in SW at higher elevations
E20i	*Silvertop Ash Ironstone Forest*	*Eucalyptus sieberi*		Grassy/Doryanthes	On red soils on east of O'Hares near Freeway. Could well be a variant of shale forests.

API Code	Name	Dominant Species	Other Species Present	Vegetation Structure	Where
E21	*Sydney Peppermint - Silvertop Ash Forest*	*Eucalyptus sieberi, E. piperata*			High Rainfall on Sandstone
E21a	*Sydney Peppermint Silvertop Ash Blue Gum*				
E21c	*Transitional Silvertop Peppermint*	*Eucalyptus sieberi, E. piperata*			Shale influenced sandstones near south western corner near Alpine
E22	*Sydney Peppermint Tall Forest*	*Eucalyptus piperata*		Grassy or heathy depending on Shale Influence	Extensive on Sandstone and Shales south from Bulli. Marks transition between E23 and E16 or 15
E22a	*Narrow-leaved Peppermint Tall Forest*	*Eucalyptus piperata, E. radiata*			South and South Western Section on sandstone Shale Interface. May also occupy the rim around *Eucalyptus ovata* Swamps on E34
E22e	*Peppermint - Mountain Gum*	*Eucalyptus piperata, E. cypellocarpa*			
E22f	*Narrow-leaved Peppermint*	*Eucalyptus radiata*			Undescribed community in the shale geologies south of Kangaloon near Wingecarribee Swamp
E23	*Sandstone Plateau Woodland*	Scribbly Gum, *Eucalyptus sieberi, Corymbia gummifera, E. piperata, E. oblonga/globoidea/ capitellata*			Generally driven by more open canopy. on rocky slopes benches and exposed slopes high *Banksia serrata*
E23a	*Enriched Sandstone Plateau Woodland*	Scribbly Gum, *Eucalyptus sieberi, Corymbia gummifera, E. piperata, E. oblonga/globoidea/ capitellata*		may exclude Scribbly gums in small patches	A taller denser woodland on plateaux and wide ridges or on different sandstone geology
E23b	*Angophora bakeri Woodland*	Scribbly Gum, *Angophora bakeri*			One patch only not mappable from API. *A bakeri* dominant with an E23 complex.
E23c	*Sandstone Plateau Woodland with Angophora*	Scribbly Gum, *Angophora costata*			Woronora Catchment only
E23d	*Naturally Open E23*	As per E23			A more open variant but not a 10a

API Code	Name	Dominant Species	Other Species Present	Vegetation Structure	Where
E23g	*South Western Sandstone Plateau Woodland*	Scribbly Gum, sometimes *Eucalyptus mannifera, E. sieberi, E. radiata*	grassy to low heath		Larges broad plateaux with *Poa* grass at high elevation
E23i	*Ironstone Sandstone Woodland*	Scribbly Gum, *Eucalyptus sieberi, Corymbia gummifera, E. piperata, E. oblonga/globoidea*			Low stunted version of Ridgetop Woodland on distinct geology of ridges in Woronora Catchment
E23s	*Sandstone Plateau Woodland on Broad Plateaux*	Scribbly Gum dominant almost monospecific		heathy	Central to northern
E24	*Angophora Sydney Peppermint Sheltered Forest*	*Angophora costata, Eucalyptus piperita*			Hawkesbury sandstone gullies north of Cataract-Appin Road
E24a	*Sheltered Angophora Peppermint Grey Gum Forest*	*Angophora costata, Eucalyptus punctata, E. agglomerata, E. piperata*			In deep northern gullies near Woronora dam
E32	*Brown Barrel Tall Forest*	*Eucalyptus fastigata* sometimes *E. cypellocarpa, E. smithii, E. elata*		Grassy to Moist	Dominant on Robertson Basalt
E34	*Swamp Gum Woodland*	*Eucalyptus ovata*	*Melaleuca linariifolia*		At the interface between Basalt and Shale Geologies. Can be a tall forest
E34a	*Swamp Gum Woodland with Narrow-leaved Peppermint*	*Eucalyptus ovata, E. radiata, E. mannifera*			Open Drainage lines in SW of Study Area amongst E23g
E35a	*Deep South West Sheltered Grey Gum Forest*	*Eucalyptus punctata, E. agglomerata, E. elata, Corymbia gummifera* can include *E. cypellocarpa*			Sheltered South west Gully Forests
E35b	*Sheltered Grey Gum -Blackbutt Forest*	*Eucalyptus punctata, E. pilularis, E. piperata*		Shrubby	Deep gorges and gullies north of Cataract Creek
E35c	*Sheltered South West Peppermint Stringybark*	*Eucalyptus agglomerata, E. piperata, E. sieberi*			Drier gullies and upper slopes

API Code	Name	Dominant Species	Other Species Present	Vegetation Structure	Where
E35d	*South Western Tall Forest (Burke River*	Eucalyptus punctata, Eucalyptus quadrangulata, Eucalyptus elata, Eucalyptus tereticornis, Eucalyptus, agglomerata, Eucalyptus smithii	Lomandra longifolia	Tall Open Forest	Burke River slopes on shale influences colluvial soils
E35e	*Nepean Peppermint*	*Eucalyptus piperata*			Exposed slopes on Warragamba Geology
E36	*Sheltered Peppermint Forest*	*Eucalyptus piperata, Corymbia gummifera*			Dominant sheltered gully forest of Hawkesbury Sandstone Forest South from Appin
Plateau Mallees					
E17	*Plateau Mallee*	*Eucalyptus apiculata*	*Leptospermum* spp., *Baeckea* spp.	Woodland with shrub understorey	outcrops of Hawkesbury sandstone. - little bit above Dapto
E18 has been mapped as E17	*Plateau Heath Woodland*	*Eucalyptus stricta, Banksia ericifolia, Hakea teretifolia*	*Leptospermum attenuatum, Banksia paludosa, B. robur, Sprengelia sprengelioides, Empodisma minus, Gymnoschoenus sphaerocephalus, Eucalyptus stricta*	Low woodland with heath and sedgeland understorey	scrub with occasional emergent mallee - (Macquarie Pass) the mallee occurs in drier spots and where it is moist it merges with sedgeland - perched alluvium on Hawkesbury sandstone - open heath with closed sedge layer
E19 has been mapped as E34	*Wianamatta Shale Scrub*	*Eucalyptus ovata, Melaleuca linariifolia*	*Acacia longifolia, Pteridium esculentum, Blechnum cartilagineum, Schoenus melanostachys*	Low woodland with scrub	gently sloping shales , on fringes of basalt outcrop on Macquarie hill , scrub up to 5 m high with scattered trees up to 10m high . (Macquarie pass-community 2)
E37	*Woronora Mallee Heath Woodland Complex*	Scribbly Gum (*Eucalyptus haemastoma*), *E. luehmannii, E. sieberi, Corymbia gummifera*			A complex of open scribbly woodland and Mallees.
E37p	*Woodland/Mallee on Rocky outcrops on Mesas*	Scribbly Gum (*Eucalyptus haemastoma*), *E. luehmannii, E. sieberi, Corymbia gummifera*			
Plateau Heaths					
H8b	*Plateau Banksia Scrub*	*Banksia ericifolia, Hakea teretifolia*		Plateau scrub	margins Quaternary sand / Hawkesbury - damp - O'Hares Creek , Darkes Forest

API Code	*Name*	*Dominant Species*	*Other Species Present*	*Vegetation Structure*	*Where*
H8	*Plateau Wet Heath*	*Banksia oblongifolia, B. robur, Hakea teretifolia*		Plateau scrub	Quaternary alluvium perched on Hawkesbury -Maddens Plains. Open heath with closed herb layer
H8a	*Plateau Damp Heath*				
H8b	*Plateau Wet Heath Thicket*				
H8d	*Drainage Lines*	Tea-tree, sedges, *Gleichenia, Sticherus*.			
H16	*Allocasuarina Heath*				
H16a	*Allocasuarina littoralis Heath*				
H24 mapped as H8	*Open Heath*	*Banksia ericifolia, Hakea teretifolia, B. paludosa, B. robur*	*Leptospermum attenuatum, Sprengelia sprengelioides, Empodisma minus, Gymnoschoenus sphaerocephalus*	Plateau scrub	scrub with occasional emergent mallee - (Macquarie Pass) the mallee occurs in drier spots and where it is moist it merges with sedgeland - perched alluvium on Hawkesbury sandstone - open heath with closed sedge layer
H28	*Rock Pavement Heath*	*Kunzea ambigua, Darwinia fascicularis*	Can include Mallees	Heath	on massive sandstone pavements of Woronora Plateau - south Darkes Forest, soils skeletal Hawkesbury sandstone
L7	*Cliff Complex Shrubland*				
L8	*Sandstone Tor Shrubland Complex*				
H9	*Allocasuarina diminuta Heath*	*Allocasuarina diminuta*	*Hakea dactyloides, Banksia spinulosa, Lepyrodia*		At the racecourse east of Mittagong
Coastal heath, scrubs and grasslands					
H	*Shrubland*				
HG	*Exposed Grassland*	*Themeda australis*	*Lomandra longifolia, Glycine* spp.	Herbland	Wollamai Point, Bolgo - Bald Hill, Minnamurra, Killalea
Q1	*Native Grassland*				
Q3	*Native Grassland*	*Themeda australis*			
Q4	*Native Tussock Grass*	*Poa* spp.			
G	*Acacia Scrubs*				
G2	*Acacia and other Turpentine Scrubs*				

API Code	*Name*	*Dominant Species*	*Other Species Present*	*Vegetation Structure*	*Where*
Hydrophytic					
F	*Melaleuca Forest*				
F	*Melaleuca ericifolia swamp scrub*	*Melaleuca ericifolia*	*Baumea* spp , *Persicaria* spp., *Casuarina glauca*	Closed forest	Q alluvium, Bellambi, Puckeys, Korrongulla, Windang - floodplain adjacent estuarine lagoon or dunal swamp on coastal plain
T	*Common Reedland*	*Phragmites australis*	*Cyperus* spp., *Baumea* spp., *Bolboschoenus* spp.	Reedland	wetland fringes - lake foreshore
T1	*Reedland*	*Typha orientalis*			
TXR		Scattered Trees above a rural land use			
TXU		Scattered Trees above urban development			
J	*Sedgeland*	*Baumea* spp., *Juncus* spp., *Villarsia* spp.		Sedgeland	Quaternary alluvium , Windang, lake foreshore
J4	*Disturbed Sedgeland*				
J5	*Open Herbland*	*Enchylaena tomentosa*		Open herbland	Big Island , rocky fringe often sea island - open herbland – NCC
D	*Disturbed Habitats*	*Acacia mearnsii* Scrub			
V		Exotic Canopy (including plantation)			
R	*Rock*				
P		Lantana Scrub			
T	*Reedbeds*				
X	*Cleared Land*				
XB		Cleared with moist shrub regeneration			
XC		Visible evidence of cultivation, cropping or hay cutting – no native tree cover			
XG		Cleared with *Acacia* regeneration			
XH		Cleared with Heath Regeneration (Powerline easement typical)			

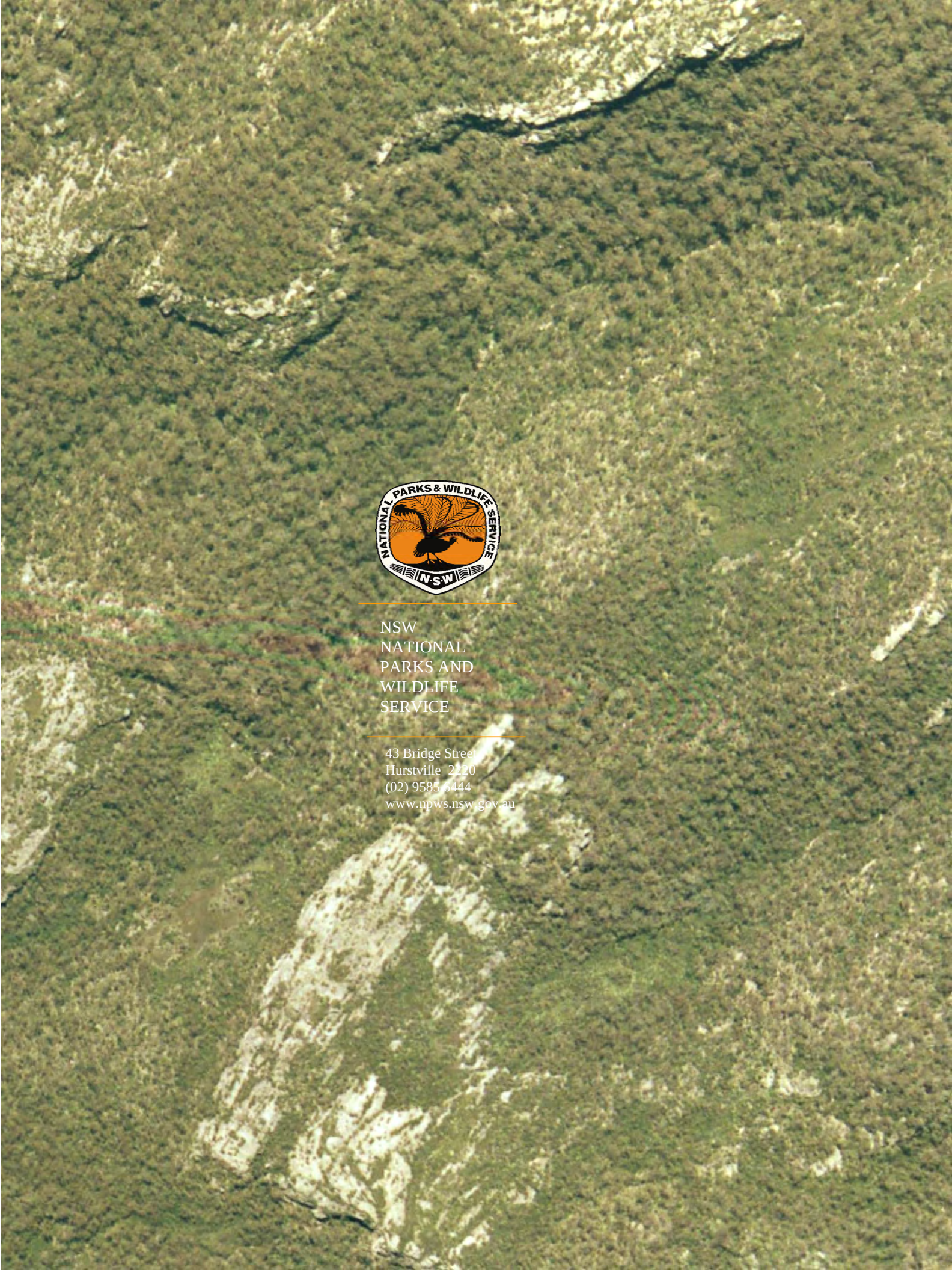
API Code	*Name*	*Dominant Species*	*Other Species Present*	*Vegetation Structure*	*Where*
XP		Cleared with Lantana understorey			
XU		Cleared with Urban Land Use			
XQ		Unimproved Exotic pasture Grasses			
XR		Rural Residential Landscape no native tree cover			
Y	*Sand*				
V	*Exotic Tree*				
W	*Water Bodies*	Natural			
W2	*Dams*	Human			
W4	*Lagoon*				
W7	*Deeper Water*				
L	*Land Slips*				
L1	*Land Slips*				
L3	*Coal Waste Emplacements*				
L4	*Land Fill*				
L6	*Quarry*				
L7	*Cliff Complex Shrubland*	*Eucalyptus sieberi, E. dendromorpha, Allocasuarina verticillata*			thin line of exposed moist and mesic cliff edge species blending sandstone and rainforest elements
L8	*Sandstone Tor Complex*	*Eucalyptus sieberi, Corymbia gummifera*			
Z	*Weeds*				

APPENDIX E: API CODES AND HABITAT CHARACTERISTICS FOR MAP UNITS.

Map Unit	Vegetation Community Name	API Code	Understorey Code	Geology (Median Score)	Mean Elevation (metres)	Mean Rainfall (mm)	Aspect Class (Modal Score)
MU1	Illawarra Escarpment Subtropical Rainforest	R6		Cordeaux Crinanite	377 (364-390)	1462	135-225
MU2	Coachwood Warm Temperate Rainforest	R1, R7		Narrabeen Sandstones	360 (308-453)	1504 (1409-1585)	135-225
MU3	Robertson Cool-Warm Temperate Rainforest	R8, G		Basalt	710	1610	
MU4	Sandstone Riparian Scrub	R1a, R1b		Hawkesbury Sandstone	182 (60-340)	1140(931-1314	Riparian
MU5	Cliffline Coachwood Scrub	L7		Hawkesbury Sandstone	390-550	>1600mm	
MU6	Moist Blue Gum-Blackbutt Forest	E13, E13a, E15	A,B	Narrabeen Sandstones and Shales	329 (298-350)	1497(1439-1555)	135-225
MU7	Moist Coastal White Box Forest	E1		Narrabeen Sandstones and Shales			
MU8	Moist Gully Gum Forest	E16,E16a, E16b, E16c, E16d	A,B	Narrabeen Sandstones and Shales	403 (309-450)	1580(1580-1633)	45-135
MU9	Nepean Gorge Moist Forest	E35a, E16c	A,B	Mittagong and Hawkesbury Sandstones	348 (269-489)	1027 (999-1053)	45-135
MU10	Robertson Basalt Brown Barrel Forest	E32, E16e		Basalt	727 (652-817)	1470 (1332-1660)	315-45
MU11	Moist Shale Messmate Forest	E16e	A,B	Shale	654 (580-711)	1441 (1418-1466)	45-135
MU12	Highlands Ribbon Gum Gully Forest						
MU13	Tall Open Gully Gum Forest	E16, E16a, E16b	B,C,D	Narrabeen Sandstones	416 (385-472)	1484 (1434-1522)	135-225
MU14	Tall Open Peppermint-Blue Gum Forest	E22, E22a, E21a, E22e	B,C,D	Narrabeen Sandstones	354 (317-390)	1473 (1373-1542)	135-225
MU15	Tall Open Blackbutt Forest	E15, E15d	B,C,D	Narrabeen Sandstones	335 (297-410)	1428 (1232-1554)	315-45
MU16	Tall Blackbutt-Apple Shale Forest	E15c		Shale caps and Shale Enriched Sandstones	282 (276-290)	1396 (1389-1404)	315-45

Map Unit	Vegetation Community Name	API Code	Understorey Code	Geology (Median Score)	Mean Elevation (metres)	Mean Rainfall (mm)	Aspect Class (Modal Score)
MU17	O'Hares Creek Shale Forest	E9g		Shale and shale enriched Hawkesbury Sandstone	368 (210-434)	1414 (1027-1542)	45-135
MU18	Highlands Shale Tall Open Forest	E16e, E50, E22a, E9t, E9q, E9l, E22f		Shale and shale enriched Mittagong Sandstones, Trachyte Intrusions	609 (468-677)	1223 (1084-1618)	45-135
MU19	Transitional Shale Open Blue Gum Forest	E9d		Shale	NA	NA	NA
MU20	Cumberland Shale Hills Woodland	From NPWS (2000a) and E9r		Shale	NA	NA	NA
MU21	Cumberland Shale Plains Woodland	From NPWS (2000a) and E9r		Shale	NA	NA	NA
MU22	Transitional Shale Dry Ironbark Forest	E9a, E9b, E9f, E9c		Shale	288 (43-475)	997 (896-1179)	Flat
MU23	Transitional Shale Stringybark Forest	E9s		Shale enriched Hawkesbury and Mittagong Sandstones	NA	NA	NA
MU24	Highlands Alluvial Red Gum Woodland	E9e		Shale	>700m	<950mm	
MU25	Sandstone Gully Apple-Peppermint Forest	E24, E24a		Hawkesbury Sandstone	265 (119-330)	1289 (1104-1474)	135-225
MU26	Sandstone Gully Peppermint Forest	E36		Hawkesbury Sandstone	424 (259-520)	1366 (1068-1601)	45-135
MU27	Nepean Sandstone Gully Forest	E35c, E35d		Hawkesbury Sandstone	330 (264-440)	1048 (983-1144)	45-135
MU28	Western Sandstone Gully Forest	E35b		Hawkesbury and Mittagong Sandstone	154 (40-264)	948 (895-1023)	45-135
MU29	Exposed Sandstone Scribbly Gum Woodland	E23; E10		Hawkesbury Sandstones	401 (250-577)	1305 (982-1640)	315-45
MU30	Nepean Enriched Sandstone Woodland	E23a		Mittasgong Sandstones	515 (344-624)	1076 (981-1401)	45-135
MU31	Highlands Sandstone Scribbly Gum Woodland	E23g		Mittagong and Hawkesbury Sandstones	611 (609-616)	1184 (1163-1223)	
MU32	Escarpment Edge Silvertop Ash Forest	E20		Hawkesbury Sandstone			
MU33	Silvertop Ash Ironstone Woodland	E20l, E23l		Ironstone Mantle on Hawkesbury Sandstone			

Map Unit	Vegetation Community Name	API Code	Understorey Code	Geology (Median Score)	Mean Elevation (metres)	Mean Rainfall (mm)	Aspect Class (Modal Score)
MU34	Sandstone Heath-Woodland	E10		Hawkesbury Sandstone	286 (210-368)	1363 (1227-1540)	
MU35	Upper Georges River Sandstone Woodland	E9h and modelled area see NPWS (2000b)		Mittagong and Hawkesbury Sandstone	NA	NA	NA
MU36	Budawang Ash Mallee Scrub	E17a		Hawkesbury Sandstone	NA	NA	NA
MU37	Dwarf Apple Heath	From (Keith, 1994)		Ironstone Mantle on Hawkesbury Sandstone	NA	NA	NA
MU38	Rock Pavement Heath	H28		Hawkesbury Sandstone	NA	NA	NA
MU39	Rock Plate Heath-Mallee	L8, E17		Hawkesbury Sandstone	NA	NA	NA
MU40	Woronora Tall Mallee-Heath	E37, E37p		Hawkesbury Sandstone			
MU41	Highlands Sandstone *Allocasuarina* Heath	H9		Mittagong Sandstone	580 (575-588)	1052 (1030-1072)	
MU42	Upland Swamps: Banksia Thicket	H8b		Quaternary Alluvium Deposits on Hawkesbury Sandstone	NA	NA	NA
MU43	Upland Swamps: Tea-tree Thicket	H8d		Quaternary Alluvium Deposits on Hawkesbury Sandstone	NA	NA	NA
MU44	Upland Swamps: Sedgeland-Heath Complex	H8		Quaternary Alluvial Deposits on Hawkesbury Sandstone	431 (255-578)	1435 (1283-1504)	NA
MU45	Upland Swamps: Fringing Eucalypt Woodland	E10a/H8, E23/H8, E20/H8		Quaternary Alluvial Deposits on Hawkesbury Sandstone	NA	NA	NA
MU46	Upland Swamps: Mallee-Heath	E17/H8		Quaternary Alluvial Deposits on Hawkesbury Sandstone	NA	NA	NA
MU47	Highlands Sandstone Swamp Woodland	E34a, E10g/H8		Mittagong and Hawkesbury Sandstones	NA	NA	NA
MU48	Highlands Swamp Gum-*Melaleuca* Woodland	E34		Interface of Basalt and Shale Geologies	NA	NA	NA



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