

Appendices

Appendix 1:

Goulburn Broken Vegetation Plan Steering Committee



Standing from left to right:

Russell Pell	Farmer – representing Goulburn Broken Waterways and United Dairyfarmers of Victoria, Wyuna
Lesley Dalziel	Environmental Alliance representative, Seymour
Pat O'Connor	Farmer – representing Upper Goulburn Implementation Committee, Mangalore
Bill O'Kane	Chief Executive Officer, Goulburn Broken Catchment Management Authority, Shepparton
Susan Sleigh	Farmer – representing Victorian Farmers Federation, Euroa
Kevin Ritchie	Manager – Flora, Fauna and Fisheries North East Region, Department of Natural Resources and Environment, Benalla
Paul Ryan	Bushcare Facilitator, Goulburn Broken Catchment Management Authority, Shepparton
Mark Cotter	(Guest) Specialist support, Department of Natural Resources and Environment, Benalla

Seated from left to right:

Caroline Douglass	Manager – Native Vegetation, Department of Natural Resources and Environment, Catchment Management and Sustainable Agriculture, Melbourne
Rod McLennan	Biodiversity Co-ordinator, Department of Natural Resources and Environment, Institute of Sustainable Irrigated Agriculture, Tatura
Dianne McPherson	Board Member (and Goulburn Broken Catchment Vegetation Management Plan Steering Committee Chair), Goulburn Broken Catchment Management Authority, Shepparton
Margaret Hatton	Upper Goulburn Implementation Committee, Kilmore

Absent:

Dennis Leavesley	Environmental Alliance representative, Shepparton
Roger Wrigley	University of Melbourne, Dookie Campus, Dookie – representing Goulburn Broken Waterways
Linda Brownstein	Municipal Catchment Co-ordinator, Goulburn Broken Dryland Municipalities, Euroa
Bruce Gill	Municipal Catchment Co-ordinator, Goulburn Broken Irrigation Municipalities, Shepparton

Appendix 2: Goulburn Broken Broad Vegetation Types

BVT Coverage: Pre-European Settlement and 1993

BROAD VEGETATION TYPE	Pre-European Total Area [^]	Forested 1993								
					Public Land				Private Land	
		Total Area		Conservation		Other		Total		
		Ha	%*	Ha	%*	Ha	%*		Ha	%*
Dry Foothill Forest	709,159	351,064	50	54,690	8	214,117	30	268,815	82,249	12
Moist Foothill Forest	209,315	152,285	73	20,583	10	113,909	54	134,501	17,783	8
Montane Dry Woodland	66,255	65,950	100	8,728	13	57,191	86	65,933	17	0
Montane Moist Forest	5,635	5,259	93	248	4	4,946	88	5,199	60	1
Sub-Alpine Woodland	6,445	6,368	99	1,575	24	4,793	74	6,393	0	0
Plains Grassy Woodland	848,336	17,486	2	1,314	0	5,797	1	7,112	10,374	1
Valley Grassy Forest	16,209	1,533	9	28	0	504	3	532	1,002	6
Herb-Rich Woodland	97,287	7,303	8	114	0	3,058	3	3,171	4,131	4
Sub-Alpine Grassy Woodland	2,323	2,140	92	614	26	1,525	66	2,166	0	0
Montane Grassy Woodland	6,592	6,557	99	127	2	6,430	98	6,559	0	0
Riverine Grassy Woodland	129,293	48,440	37	7,351	6	36,188	28	43,545	4,896	4
Box Ironbark Forest	288,082	64,207	22	2,218	1	46,251	16	48,469	15,738	5
Inland Slopes Woodland	22,034	7,027	32	3,812	17	98	0	3,927	3,100	14
<i>Softwood (Conifer) Plantation@</i>		18		0		16		16	1	
TOTAL AREA, Ha	2,406,965	735,619		101,402		494,807		596,321	139,351	

* percentage of original Broad Vegetation Type Remaining. NRE's 1993 *Tree 100 layer* used to calculate areas remaining. Minor discrepancies occur due to different scales of data captured (1:250,000 and 1:100,000).

[^] Total area does not include all of landscape, such as lakes. Terminology used in this Goulburn Broken Native Vegetation Management Strategy is *pre-European* rather than *pre-1750* to simplify communication. (Pre-1750 is terminology used on NRE Corporate Database from which BVT information extracted.)

@ 1987 Forest Type (1:500,00) data used.

Information derived from NRE's Corporate database. Refer also to notes on Table 1: Land Use in the Goulburn Broken Catchment.

Descriptions of each BVT

Riverine Grassy Woodland

Riverine Grassy Woodlands are typically associated with riparian floodplains that are subject to frequent periodic inundation from adjacent creeks and river systems. Dominated by River Red Gum (*Eucalyptus camaldulensis*), these forests and woodlands have an open structure with an understorey of sedges and grasses. Shrubs such as Silver Wattle (*Acacia dealbata*) are common on riparian margins. Box-dominated woodlands occur on elevated, less frequently inundated sandy ridges. Typical species associated with these Box ridges include Grey Box (*Eucalyptus microcarpa*), Yellow Box (*Eucalyptus melliodora*) and Buloke (*Allocasuarina luehmannii*). A diverse range of wetlands occurs throughout the Riverine Grassy Woodlands.

The alteration of flooding regimes (that is, the frequency, intensity and seasonality of flooding), which is so crucial to the health and regeneration of the River Red Gum forests, is a significant threat to this BVT. Changed flooding regimes, inappropriate grazing and timber extraction practices have substantially modified the composition and structure of the Riverine Grassy Woodland BVT.

Plains Grassy Woodland

Previously one of the most extensive vegetation complexes in temperate Australia, the Plains Grassy Woodlands have been severely depleted since European settlement. They are characterised by natural expanses of grasslands and grassy woodlands with widely spaced trees and scattered shrubs, occurring on the relatively flat, fertile riverine plains. Plains Grassy Woodland is dominated by Box eucalypt species and White Cypress-pine (*Callitris glaucophylla*), Buloke (*Allocasuarina luehmannii*), Wattles (*Acacia* sp.) and peas of the genera *Dillwynia* and *Eutaxia* are common in the understorey. The ground layer is generally diverse and includes a wide range of grasses, lilies and forbs.

The Plains Grassy Woodlands have been extensively cleared and many flora and fauna species reliant on this vegetation type have declined dramatically since European settlement.

Key on-going threats to this BVT are now more subtle and include the effects of rising water tables, altered grazing and fire regimes, incremental clearing and invasion of dominant native and exotic species.

Herb-Rich Woodland

This BVT supports floristically diverse vegetation complexes that occur on the older alluvial terrace of the plains. Local dominants include Yellow Box (*Eucalyptus melliodora*), Long-leaf Box (*Eucalyptus goniocalyx*) and Blakely's Red Gum (*Eucalyptus blakeyi*) with a floristically diverse understorey comprising many herbaceous, orchid and lily species.

This species-rich community has been severely modified since European settlement. Incremental clearing, weed invasion, grazing and timber removal threatens the existing biodiversity values and impedes regeneration of this BVT.

Box-Ironbark Forest

Considerable variation exists in the floristic composition of the Box-Ironbark Forests relative to local environmental variation in topography, soils and rainfall. In the Rushworth-Heathcote area, Red Ironbark (*Eucalyptus tricarpa*) and Grey Box are the dominant eucalypts, with some gradations into Red Box (*Eucalyptus polyanthemus*) and Red Stringybark (*Eucalyptus macrorhyncha*) on drier slopes and Yellow Gum (*Eucalyptus leucosylon*) in lower gullies and other moist areas.

The shrubby understorey components include Golden wattle (*Acacia pycnantha*), Gold Dust wattle (*Acacia acinacea*), other Acacias and various heath and native pea species. The ground cover is typically sparse, but includes a diverse range of grasses, orchids and lilies.

On the low hills in the north-east of the Catchment, the subtle shift in Box-Ironbark community composition is largely related to increased rainfall and soil quality. Red Ironbark gives way to Mugga Ironbark (*Eucalyptus sideroxylon*) and shifts in understorey composition are also evident. The diversity and cover of shrub and grass species is considerably higher in this part of the Box-Ironbark system. Grassy woodlands of White Box (*Eucalyptus albens*) and Yellow Box (*Eucalyptus melliodora*) are supported on the more fertile soils of this region.

The biodiversity values of the Box-Ironbark Forests are degraded by a range of historical and current threatening processes. Large areas of this vegetation type, particularly in the Rushworth-Heathcote forests, have been disturbed by mining and timber extraction, while grazing and firewood collection is still a major threat to Box/Ironbark Forests on private land.

Inland Slopes Woodland

This vegetation complex occurs on low hills of granitic origin at equivalent to slightly higher elevations than the Box-Ironbark and Grassy Woodland BVTs. Inland slopes woodlands occur on sandy soils and are characterised by Blakely's Red Gum, Red Stringybark, White Cypress-pine and a dense, species-rich understorey.

The Inland Slopes Woodland BVT has declined extensively. Weed invasion, increased nutrient levels and grazing pressures threaten the remaining areas of this BVT.

Valley Grassy Forest

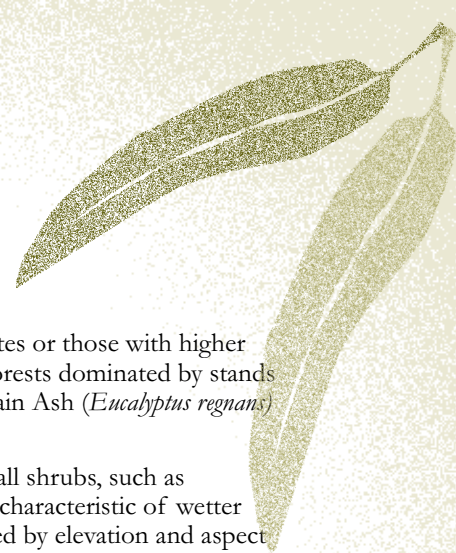
These forests occur in the valleys of the foothills and lower slopes of the Great Dividing Range. Dominant overstorey species may include Yellow Box, Candlebark (*Eucalyptus rubida*), Apple Box (*Eucalyptus bridgesiana*), Long-leaf Box (*Eucalyptus goniocalyx*) and occasionally Red Box and Red Stringybark. A tall shrub layer of Silver Wattle and a diverse grassy ground layer of grasses, herbs and lilies is typical in some parts of this BVT.

Because of their suitability for agriculture, the Valley Grassy Forests have been heavily cleared. Grassy weeds including Phalaris (*Phalaris* sp.) are further displacing native species particularly on forest margins and in heavily grazed remnants.

Dry Foothill Forest

Dry Foothill Forest occurs in low rainfall belts in foothills and associated mountain range country in the southern half of the catchment. A Red Stringybark – Red Box – Broad-leaf Peppermint (*Eucalyptus dives*) association dominates the vegetation with variation occurring with altitude. The understorey composition is influenced by the prevailing aspect (direction a slope faces) and can be shrubby, heathy, or grassy depending on local topographical influences.

Once covering an extensive area, this vegetation type has also been extensively cleared. Fifty per cent of the original vegetation cover of this BVT remains in the Catchment but most of this exists largely as scattered remnants on both public and private land. The combined pressures of weed invasion and increased grazing pressure threaten biodiversity values and reduce the regeneration potential in vegetation remnants. Only eight per cent of this vegetation type is protected in the conservation reserve system.



Moist Foothill Forest

This vegetation type occurs in association with dry foothill forests but occupies protected sites or those with higher effective rainfall and often at higher elevations. The comparatively fertile soils support tall forests dominated by stands of Messmate (*Eucalyptus obliqua*) and Narrow-leaved Peppermint (*Eucalyptus radiata*). Mountain Ash (*Eucalyptus regnans*) and Manna Gum (*Eucalyptus viminalis*) tend to dominate in wetter areas.

A more complex understorey also occurs in this vegetation type and understorey trees and tall shrubs, such as Blackwoods (*Acacia melanoxylon*) and Silver Wattles are common. A ferny understorey is also characteristic of wetter sites and variation in floristic composition, cover and abundance are again strongly influenced by elevation and aspect within this broad vegetation type.

Much of what does remain has also been substantially altered through timber harvesting practices. Weed invasion and altered fire regimes are substantial ongoing threats to this broad vegetation type.

Montane Moist Forest

These forests occur at high elevations with high annual rainfalls. Alpine Ash (*Eucalyptus delegatensis*) dominates the overstorey while Mountain Ash and Shining Gum (*Eucalyptus nitens*) are more common in the wetter areas. Shrubs are uncommon, however the understorey is still floristically rich. A diverse range of herbaceous species occurs on the damp soils giving way to ferns in wetter areas.

Ninety-seven per cent of the Montane Moist Forests remain, but only 7% of this is protected in conservation reserves. Logging and modifications to natural fire regimes have dramatically altered the floristic composition and structure of this BVT.

Montane Dry Woodland

The Montane Dry Woodlands occur at similar altitudes and rainfall gradients as the Montane Moist Forests; however, prevailing aspect is an important factor determining the vegetation composition and structure. The height of the overstorey is considerably reduced and resembles a low woodland structure. Dominants are Candlebarks and Mountain Grey Gum (*Eucalyptus cypellocarpa*) with Alpine Ash and Snow Gums (*Eucalyptus pauciflora*) being less abundant but still common. Various heath species and tough, coarse grasses occur in the understorey and these reflect the harsh environmental conditions at this altitude.

As for the Montane Moist Forests, weed invasion, altered fire regimes and changes to vegetation composition and structure due to logging are important issues in this BVT.

Montane Grassy Dry Woodland

These are similar in composition and structure to the Montane Dry Woodlands, with a notable difference being the increased diversity and abundance of grasses and herbaceous species. Issues of weed invasion and the alteration of habitat resources related to timber harvesting persist.

Sub-Alpine Woodland

This vegetation type occurs at altitudes between 1200 and 1400 m in elevation and where annual rainfall exceeds 1400 mm. The vegetation is a stunted woodland dominated by Snow Gums with various grass and heath/shrub species making up the understorey. There are small areas of naturally treeless vegetation.

While all the original area of Snow Gum Woodland remains, only 3% is protected in conservation reserves. Significant changes have been imposed in some areas due to recreational developments, particularly related to skiing. Woody weeds such as English Broom (*Cytisus scoparius*), blackberries (*Rubus fruticosus* sp. agg.) and various grass species have exploited disturbed areas. English Broom a particular problem where changed fire regimes have influenced the vegetation composition.

Sub-Alpine Grassy Woodland

This community shares many features of the Sub-Alpine Woodlands and is distinguished by a greater diversity and abundance of grasses. The cover of this vegetation type has not declined but subtle changes in the composition and structure of this BVT have occurred from localised disturbances such as those described for the Sub-Alpine Woodlands.

Wetlands

Some 1,831 wetlands totalling 83,595 ha have been identified in the Catchment but only 39 (4,753 ha) are protected in conservation reserves. Since European settlement, 526 wetlands (20,076 ha) have been drained and most others have been subjected to modification of drainage regimes to some extent.

Summary of key features of BVTs

BVT COMPLEXES	LOCATION EXAMPLE	RAINFALL ALTITUDE	COMMON VEGETATION DESCRIPTION	RARE SPECIES, EXAMPLE
Riverine Grassy Woodland & Forests (Floodplains)	Goulburn River Barmah Forest	350-700mm < 300 m	River Red Gum Forests and Woodlands, Black Box Woodlands, Wetland complexes Box Woodlands on areas of deposited sand and silt: Yellow Box, Buloke, Grey Box.	Murray Cod; Golden Perch; Squirrel Glider; Small Psoralea.
Plains Grassy Woodland & Grasslands	Echuca Airfield	400-700mm < 200m	Grasslands (natural and artefact of clearing) & wetlands Grassy Woodlands; Grey Box, White Box, Yellow Box, Buloke, White Cypress-pine	Grey-crowned Babbler; Bush Stone-curlew; Mountain Swainson-pea.
Herb-Rich Woodland	Reef Hills Regional Park (south-west corner)	500-600mm < 300m	Yellow Box, Red Gum, White Box, with a very diverse range of herbs, sedges, lilies & grasses; mini wetlands.	Ausfeld's Wattle; Purple Diuris.
Box-Ironbark Forest	Whroo-Costerfield State Forest (Rushworth area)	400-600mm < 400m	Box Ironbark Forest; Mugga, Grey Box, Red Box, Yellow Gum with a shrubby understorey. Gullies/ drainage lines with Red Gum Creeks & Herb-Rich Woodlands of Yellow Box and White Box.	Tuan; Regent Honeyeater; Orchids (several); Kamarooka Mallee.
Inland Slopes Woodland	Chesney Vale Hills, Warby Range	500-700mm < 500m	Granite Hills Woodland with Blakely's Red Gum, White Cypress Pine & She-oak. Heathy Woodland with Long-leaf Box & Red Box. Rocky Outcrop Shrubland/Herblands. Spring-soak Herbfields	Square-tailed Kite; Carpet Python; Spur-winged Wattle; Narrow Goodenia.
Valley Grassy Forest	Valleys in foothills, Tatong	650-750mm 150 - 400m	Yellow Box, Candlebark, White Box, Red Box and Silver Wattle with a low grassy understorey. Riparian woodlands and forests; Red Gum to Swamp Gum	Large-footed Myotis (bat); Catkin Wattle.
Dry Foothill Forest	Strathbogie Range – slopes	600-800mm 300-900m aspect dependent	Dry Forest types with mixed overstorey; Red Stringybark, Red Box, Long-leaf Box +/- Broad Leaf Peppermint. Understorey shrubby, heathy or grassy, depending on aspect.	Common Bent-wing Bat; Golden Sun Moth; Hickory Wattle; Narrow-leaf Star-hair.
Moist Foothill Forest	Mt Samaria – top plateau of the Strathbogie Range	800-1400mm 500-1000m aspect dependent	Herb-Rich Foothill Forest with tall shrubs and diverse herbs; Narrow-leaf Peppermint, Blue Gum, Messmate, Damp Forest with groundferns; Blue Gum. Wet Forest with broad-leaf shrubs & tree ferns; Mt Ash. Riparian Forest; Manna Gum. Swampy Riparian Woodlands; Mountain Swamp Gum	Smoky Mouse; Glandular Early Nancy; Soft Ledge-grass;
Montane: Moist Forests, Dry Woodlands, Grassy Dry Woodlands	Black Range The Governors Blue Range	1000-1400mm 1000-1200m	Tall forests of Alpine Ash and Mountain Gum Manna Gum in gullies Woodlands on plateaus with tall Snow Gum and Mountain Gum. Riparian thickets dominated by Mountain Tea-tree	Broad-toothed Rat; Caddisfly; Mountain Pomaderris; Tree Geebung.
Sub-Alpine Woodlands Treeless Sub-Alpine	Mt Stirling Lake Mountain Mt Buller - top	> 1400mm 1200-1400m > 1400mm > 1200m	Woodlands of stunted Snow Gum Tree-less areas diverse: heaths, scrubs and meadows with Sphagnum bogs.	Alpine She-oak; Skink Mountain Pygmy-possum; Shining Westringia; Snow wort; Snow Coprosma.

Notes:

- 1 The table is derived from the Background Paper by Amos and Berwick.
- 2 The table provides an overview of the types of vegetation to be found in each Broad Vegetation Type, with main dominant overstorey species and some examples of rare species. This is not a complete list and the vegetation names are largely generic with some specific Ecological Vegetation Class names used.
- 3 Broad Vegetation Types with similarities in land use and threats have been combined to reduce duplication and size of the table.

Appendix 3: Goulburn Broken Catchment bioregion descriptions

Note: these descriptions are derived from the Background Paper by Amos and Bernick. See Map 2 page 11.

Victorian Riverina

Description: This is the lower part of the Catchment with alluvial soils, which are more fertile and thus productive and subsequently largely cleared. Remnant vegetation consists predominantly of Riverine Grassy Woodland BVT along the Goulburn and Murray Rivers; small, fragmented remnants of Plains Grassy Woodlands and Grasslands BVT; and areas of wetlands and streamside vegetation. The landscape is largely modified. There are some small reserves (1-5% of whole region reserved in Victoria), but these are not representative of all vegetation types. Riverine Grassy Woodland BVT is largely in State Forest, the remaining vegetation is either on private land or roadsides. Roadsides and streams/rivers provide important habitat and corridors/bio-links.

Uses: Agriculture, horticulture, recreation.

Land Managers: Private landholders; Local Government; Water Authorities/River Management; Parks Victoria (PV) & Forests Management (FM), (NRE).

Northern Inland Slopes

Description: The outlying hills of granite (Inland Slopes Woodland BVT) and sedimentary rock (Box Ironbark Forest BVT) generally have gentle slopes with skeletal soils. Small areas of Plains Grassy Woodland BVT occur on this bioregion that are typically highly depleted. This region includes: the Dookie hills; Box Ironbark Forests at Lurg, Violet Town and Killawarra; and granite hills of the Warby Ranges and Chesney Vale Hills. There is proportionally more vegetation remaining than the Riverina, but not all BVTs are well reserved or representative (5-10% of whole region reserved in Victoria). Inland Slopes Woodland BVT has the highest reservation due to the Warby Range State Park, however there are important remnants in the Chesney Vale Hills that are not well reserved. Roadsides and streams/rivers provide important habitat and corridors/bio-links within this region.

Uses: Agricultural land use usually concentrated on better watered and deeper soils along gullies – grazing; horticulture – vineyards; resource use – timber, honey bees, water catchment, and recreation.

Land Managers: Water Authorities/River Management; private landholders; FM & PP of NRE; Mining Companies.

Goldfields

Description: This region comprises the outlying ranges in central Victoria. Within the Goulburn Broken CMA this consists of the central Box-Ironbark Forest or 'Goldfields' area, which includes Rushworth, Heathcote and Costerfield forests through to Puckapunyal and Tooborac. This is an important area of vegetation but is very poorly reserved. There used to be extensive Plains Grassy Woodlands BVT on the basalt (old lava flow) between Seymour and Kilmore, which are largely cleared. Around the Seymour and Avenel areas are remnants of Riverine Grassy Woodland BVT along the Goulburn River, Box Ironbark Forests BVT, Inland Slopes Woodlands BVT and Dry Foothill forests BVT. These are largely highly depleted and poorly reserved.

5-10% of the whole region is reserved in Victoria.

Uses: Agricultural land use; horticulture – vineyards; resource use – timber, honey bees, water catchment and recreation.

Land Managers: Private landholders; Water Authorities/River Management; FM & PV (NRE); Mining Companies.

Central Victorian Uplands

Description: This region comprises the northern inland foothills from the south west of the catchment through to the east side. South and west of Kilmore are Dry Foothill Forest, and smaller areas of the Moist Foothill Forest and Herb-Rich Woodland BVTs. The section from Yea to Alexandra and Mansfield falls largely in the Dry Foothill Forest BVT. The flat valley around Mansfield was once Plains Grassy Woodland BVT. The hills south of Euroa and Benalla are largely Dry Foothill Forest, Valley Grassy Forest (of which very little remains) and small areas of Moist Foothill Forest BVTs. Near Euroa is a small outlier of Box Ironbark Forest and Inland Slopes Woodland BVTs. All BVTs are highly depleted (except Moist Foothill Forest), and all are very poorly reserved (<5%) with the majority of remnants being on private land (except Dry Foothill Forest).

Uses: Agricultural land use; horticulture – vineyards; resource use – timber, honey bees, water catchment and recreation.

Land Managers: Private landholders; Local Government; FM & PV (NRE); Water Authorities/River Management.

Highlands - Northern Fall

Description: This is largely the upper catchment area plus the Tallarook Forest and plateaus of the mid-catchment highlands from Cherry Tree Range through to the Strathbogie Range. The vegetation varies from Dry Foothill Forest and Valley Grassy Forest on lower slopes/northern gullies to Moist Foothill Forest on sheltered aspects. The plateaus have Moist Foothill Forest on top. In the upper catchment the foothill forests merge into Montane Forests and Woodlands at higher altitudes. Vegetation in the foothills and lower montane areas is not well reserved, although >10% of whole region reserved in Victoria. There is localised depletion of the foothill forests along the plateau area, while the upper catchment is largely vegetated.

Uses: Resource use – timber, water catchment; recreation; some agricultural and horticulture on lower areas.

Land Managers: Private landholders; Local Government; Water Authorities/River Management, PV & FM (NRE).

Highlands – Southern Fall

Description: These areas are of high rainfall and are more influenced by the maritime climate from the south than the continental climate north of the divide. Geographically they are east of Toolangi, south of Narbethong and south, and east, of Marysville. Note that outside these larger areas small slivers of this bioregion were picked up by the GIS analysis along the southern edge due to the differences in boundaries (these should align).

Uses: Resource use – timber, water catchment; recreation.

Land Managers: Private landholders; Local Government; Water Authorities / River Management; PV & FM (NRE).

Victorian Alps

Description: This is the higher altitude and rainfall area of the Great Dividing Range with generally deeper soil. Vegetation consists of Montane Forest BVT on slopes and Montane Woodland BVT on plateaus with Sub-Alpine Woodland areas above 1000m and Treeless Sub-Alpine areas above about 1200 m. This region is mostly public land and generally well reserved (>10% of whole region reserved in Victoria) with some high country leased for grazing. The Sub-Alpine BVTs are rare in the catchment.

Uses: Resource use – timber, water catchment; recreation; some agricultural – grazing cattle.

Land Managers: Water Authorities/ River Management; PV & FMS (NRE); Alpine Resorts Commission (ARC).

Appendix 4: Goulburn Broken Catchment – further background information

Appendix 4a: Land management history

Prior to European settlement, the area within the Goulburn and Broken River Catchments was occupied by at least six Aboriginal clans. Riparian environments were particularly important because of the abundant food resources, as were the once extensive grasslands and woodlands of the plains and foothills. The forested mountain country in the south-east was apparently not permanently occupied due to the harsh climate and unpredictable food supplies.

The land management practices of Aborigines over thousands of years, especially use of fire, had a significant influence on the ecosystems that were present at the time of European settlement.

The first European settlers in the area were the squatters of the late 1830s who drove their flocks and herds along the Goulburn and Murray rivers. Economic activity intensified during the gold rushes of the 1850s. During the 1860s and 1870s, closer settlement of the region occurred following railway expansion and provisions in the Land Acts.

The gold-mining boom had a relatively short, but significant, impact on the forests adjacent to mining areas, which were ‘decimated’ (Landcare Victoria, 1993) by mining and related activities. As interest in gold mining subsided, the extraction of timber resources from the forests and agricultural production gained momentum and vast areas of the Catchment were cleared.

Dairying became a major activity in the Goulburn Valley following the establishment of the first irrigation networks in the late 1800s. Irrigation development grew with the construction of major storage and diversion facilities including the Goulburn Weir in the 1890s, Waranga Basin in 1905, and the Eildon water storage expansion projects of the early 1900s to the 1950s.

Despite the growing battle with rabbits and soil erosion problems, overall prosperity and enthusiasm for agricultural and horticultural development continued, prompting Rural Settlement Policies and Soldier Settlement schemes.

The development that followed resulted in serious environmental degradation. The type, combination and time span over which such enormous landscape changes had occurred proved too much for the natural ecosystems. Salinity and watertable problems were first recorded around Tongala in the 1930s.

Increasingly, traditional European-style land management practices contributed to the Catchment's environmental problems. The sustainability of some current land use practices is questionable in the face of the Catchment's ecological realities and limitations. This is receiving considerable attention in current planning initiatives such as this Strategy, which follows the lead of initiatives such as the *National Ecologically Sustainable Development Strategy 1992*, *National Strategy for the Conservation of Australia's Biological Diversity 1996*, and Victoria's *Biodiversity Strategy 1997*.

Appendix 4b: Economic importance

The Catchment supports a population of 160,000 with a total employment pool of 65,000, 17,000 of whom are employed in agriculture and associated industries.

From the earliest days of European settlement, successive governments promoted land settlement schemes based on broadacre and irrigation development. Rural and soldier settlement policies reinforced the growth of strong economic activity. About two-thirds of the Catchment's 2,431,654 ha has been cleared for agriculture, grazing in the south, mixed cereal and dryland grazing in the central region, and irrigated fruit growing, dairying and livestock production in a large part of the north-west.

Irrigated agriculture in the Shepparton Irrigation Region (SIR) accounts for 270,655 ha of our land use, dryland agriculture accounts for 1,397,130 ha, and there is 690,603 ha of public land.

There are several large rural centres: Shepparton, Mooroopna, Benalla, Seymour, Cobram, Nathalia, Yarrawonga, Euroa, Mansfield, Broadford, Kilmore and Yea.

The Catchment and its network of industries is recognised as one of the nation's 'food bowls'. These industries collectively have invested hundreds of millions of dollars introducing world-class technology and international best practices to maximise export opportunities. The Goulburn Broken generates about \$5 billion a year, of which \$4.5 billion comes from the Shepparton Irrigation Region (1993-94 figures). This makes up 25% of Victoria's export earnings.

The gross farmgate value of agricultural production from the Goulburn Region is \$845 million a year. This is 16% of the State's gross value of production. The major commodity is food, but wool, timber, tourism and recreation are also vitally important to the region's economy.

The Catchment's economic growth has been at the cost of many of our natural resources. The future well-being of the Catchment community depends on striking the right balance between maintenance of the Catchment's position as a major food bowl and conservation of important water, native vegetation and other natural resources.

Appendix 4c: Location, size, climate and topography

Goulburn Broken Catchment:

- Size: 2.4 million hectares (10.5% of Victoria's total area);
- Murray Darling Basin context: 2% in area of and 11% of its stream flow;
- Topography varies: high ranges (up to 1806 m above sea level at Mt Buller) in south to flat floodplains (down to 95 m at Echuca) in north – northern half of Catchment relatively flat;
- Soil varies: mainly granitic and sedimentary ranges to alluvial soils up to 100 m deep on floodplains;
- Climate varies: cool winters in high country in south-east with persistent snow and an average annual rainfall greater than 1600 mm; rainfall decreases toward north-west to less than 450 mm a year, only one-third of annual evaporation in that area.

Goulburn River Catchment:

- Size: 1.6 million hectares – largest in Victoria (7.1% of the State's total area);
- Water: mean annual flow 3,040,000 megalitres (13.7% of the State's total); Goulburn River has Victoria's largest – and arguably most important – water supply reservoir, Lake Eildon;
- Major tributaries of Goulburn River include the Big, Delatite, Howqua and Jamieson Rivers – rise on the northern slopes of the Great Dividing Range;
- 'Heritage River': Goulburn River downstream from Lake Eildon (*Heritage Rivers Act, 1992*).

Broken River Catchment:

- Size: 772,386 ha (3.4% of Victoria's area);
- Water: mean annual flow 325,000 megalitres;
- Broken River is a tributary of the Goulburn River, joining it just south of Shepparton.
- Broken Basin includes the Broken Creek Catchment that diverges from the Broken River just west of Lake Mokoan and flows north-west to the River Murray; also includes small areas of Murray Catchment, south of River Murray;
- Barmah Forest: 29,500 ha adjoining River Murray is 'Ramsar Listed Wetland' and is part of world's biggest Red Gum forest.

Appendix 5: Major government directions – further background information

Appendix 5a: Commonwealth

One of three core objectives of the *National Strategy for Ecologically Sustainable Development 1992* is ‘to protect biological diversity and maintain essential ecological processes and life-support systems’.

Biological Diversity Strategy

In June 1993, Australia ratified the Convention on Biological Diversity, which was produced as part of the *Earth Summit* held in Rio de Janeiro in 1992. The Convention came into force in December 1993.

At the Fourth Conference of the Parties of the Convention on Biological Diversity in 1998, the Commonwealth Government presented its overall perspective on biodiversity, saying:

The *National Strategy for the Conservation of Australia's Biological Diversity*, to which each State and Territory is a signatory, provides the framework for Australia's implementation of the measures in the Convention on Biological Diversity. The goal of the Strategy is to protect biological diversity and maintain ecological processes and systems. The Natural Heritage Trust, by funding programs addressing vegetation, rivers, biodiversity, land and coasts and oceans, will be the main means through which the Commonwealth will implement the Strategy, in partnership with the States and Territories. The States and Territories also have a number of programs which contribute to implementing the Strategy and Convention and most have developed or are developing their own complementary biodiversity strategies.’

The *National Strategy for the Conservation of Australia's Biodiversity 1996* provides a framework for:

- *Integrating* the conservation and sustainable use of biodiversity into strategies, plans and programs. Key sectors include agriculture and pastoralism, fisheries, water, forests, tourism and recreation, and mining.
- *Identification and monitoring* (ecosystems, species and genetic components).
- *In situ conservation*, encouraged through funding from the Natural Heritage Trust: National Reserve System Program (which seeks to establish a *comprehensive, adequate and representative terrestrial National Reserve System*) and the Bushcare Program (for conservation outside of Reserves). State programs, which may be voluntary or regulatory, or a combination of the two, play a crucial role in conserving biodiversity outside reserves. These are complemented by a range of Local Government programs.

Greenhouse and Vegetation

The United Nations Framework Convention on Climate Change provides the focus for international action. Developed countries have agreed through the Kyoto Protocol to limit human-induced greenhouse gas emissions. This applies to all major sectors and sources.

The *National Greenhouse Response Strategy 1992* has been developed and approved by all Australian Governments. It consists of eight modules that vary from obtaining information on greenhouse gas emissions to efficient transport and from urban planning to sustainable land management.

Australia's Protocol target is to limit the growth of greenhouse gas emissions to 8% above 1990 levels in the period 2008-2012. Land clearing contributed more than 17% of Australia's total emissions in 1995. In reporting progress toward their targets, countries will count the absorption of carbon dioxide by commercial forests and other tree-planting activities since 1990. Similarly, emissions reductions achieved through reduced rates of land clearing since 1990 will also count towards a country's target.

Federal initiatives

The Commonwealth and most States and Territories have legislation and programs dealing with threatened species, ecological communities and threatening processes. Nationally, alien species are being addressed through the *National Weed Strategy* and the *National Feral Animal Control Program*, with funding from the Natural Heritage Trust.

Bushcare aims to reverse the long-term decline in the quality and extent of Australia's native vegetation and to expand revegetation activities by working with governments, industries and the community.

Farm Forestry Program promotes the incorporation of commercial tree growing and management into farming systems.

Plantations for Australia: the 2020 Vision was launched by the Commonwealth, States and industry in October 1997 and is designed to remove impediments to plantation establishment, establish a commercial plantations culture, and improve information flows. It aims to treble the area of Australia's plantation estate by 2020. This will require plantings of 80,000 hectares each year: a total of two million hectares by 2020.

Bush for Greenhouse. The uptake of carbon dioxide in trees and vegetation offers significant potential to reduce the overall level of Australia's greenhouse gas emissions. This initiative will facilitate corporate funding of Natural Heritage Trust revegetation projects through Bushcare.

National Carbon Accounting System. The development of the National Carbon Accounting System will account in detail for reductions achieved in greenhouse gas emissions and place Australia at the leading edge of assessment technology.

Appendix 5b: Victoria

Biodiversity Strategy

The aims of *Victoria's Biodiversity Strategy 1997* include development of awareness, partnerships and strategic mechanisms for actions that address flora and fauna objectives; and an emphasis on threatened or depleted types such as Box-Ironbark Forests, grasslands and riparian environments.

Our community must consider several key directions listed in *Victoria's Biodiversity Strategy 1997*:

- Build on co-operation between the Catchment Management Authorities and local councils to ensure that biodiversity values are protected in rural landscapes.
- Develop and implement Catchment Management Strategies and Regional Vegetation Plans to provide for sustainable utilisation of natural resources while enhancing nature conservation values across the landscape.
- Promote the use of Land Management Co-operative Agreements, Public Authority Management Agreements, Codes of Practice, guidelines, Environmental Management Systems (e.g. ISO 14001) and reporting on nature conservation in annual report and audits.
- Support landowners through schemes such as Landcare, property management planning, and Land for Wildlife to enhance the practical management of nature conservation and target assistance to depleted or otherwise significant habitats.
- Develop an off-reserve system within the rural landscape incorporating Public Authority Management Agreements, Trust for Nature, Land for Wildlife and other co-operative, mutually beneficial mechanisms.
- Ensure nature conservation data and advice are available and accessible to all planning processes, landholders, industry and the community for achieving ecologically sustainable development.
- Maintain a partnership model for integrated pest plant and environment management as embodied in the Good Neighbour Initiative.
- Continue to recognise significant contributions to nature conservation through State and National Landcare awards.

Goulburn Broken Regional Catchment Strategy 1997

The principles behind the Catchment Strategy are:

- A realistic approach to catchment management.
- Equal access to decision making and resources.
- The value of economic benefits should exceed the costs.
- Equitable and affordable actions.
- Agricultural production is sustainable.

Victorian Government-endorsed high-priority actions of the *Catchment Strategy* include:

General -

- Use local area planning to implement suitable land use and best management practices for the various land types and enterprises.
- Strengthen support for Landcare groups by encouraging and resourcing Landcare networks.
- Support industry and regional development authorities to expand opportunities while achieving sustainable and profitable development of land and water resources.
- Establish links with local government to ensure appropriate planning requirements are in place.
- Encourage property management planning using land capability and biodiversity assessment and Farm\$mart Program as key building blocks.
- Advise Government on development and implementation of Codes of Practice relevant to catchment management.
- Implement and enhance existing approved monitoring and assessment of programs.

Irrigation Program

- Develop and implement a Biodiversity Strategy to build on the Salinity Strategy's environmental program.
- Promote biodiversity awareness to land owners, the community and business/professional organisations.

Dryland Program

- Increase the area and quality of important conservation areas, particularly native grasslands, grassy woodlands, wetlands, stream frontages and roadsides.
- Complete ecological vegetation class mapping and incorporate into Regional Vegetation Plan.
- Encourage municipalities to complete and implement roadside and other native vegetation plans.

- Increase adoption of ecological management objectives by water management agencies, Country Fire Authority and municipalities.

Public Lands Program

- Support application of Code of Forest Practice in relation to protection of biodiversity.
- Encourage neighbouring private land managers to have input into management of reserves.
- Ensure that habitats of rare or threatened species or communities and other significant biological values are identified in Fire Protection and Prevention Plans, with appropriate fire management specified.

Municipal Planning System

The new format municipal planning schemes, being developed under the Victoria Planning Provisions, provide a consistent framework and strategic direction for decisions on land use and development. Landholders and potential purchasers might not be able to proceed with their development plans if their plans threaten significant identified aesthetic, water quality or nature conservation values.

Municipal planning schemes developed under the Victoria Planning Provisions have a number of key components. Within all Victorian planning schemes there are the following sections:

State Planning Policy Framework – This framework sets out State policy for land use and development. This framework includes the objective to “assist the protection and conservation of biodiversity, including native vegetation retention and provision of habitats for native plants and animals and control of pest plants and animals”.

Local Planning Policy Framework – This framework consists of the Municipal Strategic Statement and specific Local Planning Policies. This section sets out the local and regional strategic policy context for the municipality. It is within this section that specific issues concerning biodiversity and native vegetation are addressed. For example, specific areas of native vegetation may be identified in the Municipal Strategic Statement and local policies developed to reflect specific management requirements.

Particular Provisions – This section provides regulations for specific issues. Under these provisions, a permit is required to remove, destroy or lop native vegetation, unless exempted. Also relevant are the provisions in this section dealing with timber production.

General Provisions – These provisions provide for the administration and operation of municipal planning schemes, including detailing who are relevant referral authorities. The Department of Natural Resources and Environment is the referral authority for native flora and fauna issues.

Zones – Zones and overlays provide the mechanisms to implement the State and Local Policy Frameworks. The zones control use and development. Within zone controls there are options available that may affect land use and development, such as the Environmental Rural Zone.

Overlays – Overlays are the next level of control. Overlays are in addition to zone requirements, but may provide controls over specific issues. For example a water catchment may be in a Rural Zone like surrounding farmland, but have an Environmental Significance Overlay that would require a permit to carry out works, unless exempted.

Glossary

Common term/ acronym	Meaning
Beneficiary pays	Pricing principle where those who benefit from an action pay for the portion of the benefits they receive. (See also ‘duty of care’ and ‘polluter pays’)
Best Management Practice (BMP)	The practices that result from decisions made on the best available information.
Biodiversity	The variety of all lifeforms: the plants, animals and micro-organisms, the genes they contain, and the ecosystems of which they form a part.
Biolink (zones)	Broad regional or landscape area within which there is a high priority to manage existing native vegetation for conservation and, where possible, increase the cover of native vegetation. (<i>Flora and Fauna Guarantee Strategy</i> , Department of Conservation and Environment, Government of Victoria 1992)
Bioregions	Biogeographic regions that depict the patterns of ecological characteristics in the landscape and provide a meaningful natural framework to address landscape management and biodiversity issues. Bioregions reflect underlying environmental features such as topography, soil type and rainfall and so they often reflect patterns of land use and natural resource-based activities (including conservation).
Bioregional Networks	A group of authorities with significant natural resource management responsibilities in a specified set of bioregions in Victoria, with a primary task to ensure a co-ordinated approach to biodiversity conservation in the component bioregions. This includes reporting to Government on performance management across a range of diverse organisations and interests, and establishment of a consistent set of priorities in biodiversity conservation across the relevant bioregions.
Broad Vegetation Type (BVT)	BVTs encompass floristic and structural components of vegetation and therefore reflect geology, soil, altitude and climatic factors. BVTs have been mapped by NRE to represent the distribution of BVTs in 1750 and 1987.
Bushcare	The program name for the National Vegetation Initiative that is part of the Natural Heritage Trust established by the Commonwealth Government in 1996.
Catchment Strategy	<i>Goulburn Broken Catchment Strategy</i> . A <i>Regional Catchment Strategy</i> produced as a requirement of the <i>Catchment and Land Protection Act (1994)</i> .
Code of Practice	Defines the <i>minimum</i> standards to be followed.
Connectivity	The degree to which native vegetation is connected in terms of the ecological function of the remnants.
Degradation	Any human-induced decline in the quality of natural resources or the viability of ecosystems.
Duty of care	The term used to explain what a community generally accepts as reasonable and fair within a region. It defines the point at which the ‘polluter pays’ principle ends and the ‘beneficiary pays’ principle begins. In principle, an intervention to do something that the duty of care defines is unreasonable should not be at the expense of the duty holder – but those who benefit from the intervention. (See also ‘beneficiary pays’ and ‘polluter pays’)
Ecologically Sustainable Development (ESD)	Development that improves the total quality of life, both now and in the future, in a way that maintains the ecological processes on which life depends.
Ecosystem	The dynamic inter-relationships between all forms of living organisms and their abiotic (non-living) environment. Ecosystems function as a complex, interconnected system and, if maintained in a healthy condition, provide free ecosystem services such as the production of oxygen, soil formation, maintenance of water quality, etc.
Endangered	Species in danger of extinction whose survival is not likely in the absence of threat abatement.

Enhancement	Introduction to a place of additional individuals of one or more organisms, species or elements of habitat or geodiversity that naturally exist there. (Australian Heritage Commission 1997)
EVCs	Ecological Vegetation Classes. EVCs are based on vegetation structure and floristics (the species that occur at the site), land systems, other environmental information such as aspect, slope, elevation, rainfall, and fire frequency, and ecological responses to disturbance (Environment Conservation Council 1997). EVCs describe local patterns of vegetation diversity and again reflect environmental influences. They are more complex, variable and specific than BVTs. They have been mapped in several areas in Victoria by NRE.
Extinct	A species is presumed to be extinct if it has not been located in nature for a 50-year period.
Farm forestry/agro forestry/woodlots	Areas deliberately planted for production purposes.
GBCMA	Goulburn Broken Catchment Management Authority
IBRA	Interim Biogeographical Regionalisation for Australia
Indigenous vegetation	Native vegetation that occurs naturally in a particular area
Land manager	The person or organisation responsible for managing the land. Land tenure could be either private, public or leased public land.
Local Area Plan (LAP)	A strategic planning process that involves a community in describing where it wants to be in the future and how it intends to get there in relation to issues of environment including biodiversity, land, water and community. Elements include present status, future vision, intended works, evaluation process and negotiation and funding needs
LWRRDC	Land and Water Resources Research and Development Corporation
MDBC	Murray Darling Basin Commission
Native vegetation	Any local indigenous plant community containing throughout its growth the complement of native species and habitats normally associated with that vegetation type or having the potential to develop these characteristics. It includes vegetation with these characteristics that has been regenerated with human assistance following disturbance. It excludes plantations and vegetation that has been established for commercial purposes.
Native Vegetation Retention Controls (NVR)	Introduced into the State Section of the Planning Schemes of Local Government in 1989, a permit is required to remove, destroy or lop native vegetation (subject to some exemptions).
Natural Heritage Trust	Created in 1996 by the Commonwealth Government, and will invest \$1.25 billion in Australia's natural heritage over its first five years. It includes 18 programs.
Nature conservation	The protection and enhancement of individuals, populations and communities of plants and animals, their habitats and the ecosystems which they form. Nature conservation activities aim to maintain the natural processes that sustain ecosystems and to reduce the risk of threats that may affect ecosystems.
NRE	Department of Natural Resources and Environment.
Polluter pays	People who may or do cause pollution should pay for the full cost of preventing, controlling and minimising the impact of their activities on the environment and other people. In the context of native vegetation, pollution is degradation of native vegetation and the "polluter" is the responsible land manager. (See also 'Duty of care' and 'Beneficiary pays'.)
Precautionary principle	Lack of full scientific certainty should not be used as a reason for postponing measures to prevent environmental degradation where the threat of serious or irreversible environmental damage exists.
Principle of existence	Living organisms, earth processes, and ecosystems may have value beyond the social, economic or cultural values held by humans.

Principle of intergenerational equity	The present generation should ensure that the health, diversity and productivity of the environment is maintained or enhanced for the benefit of future generations.
Principle of uncertainty	Our knowledge of natural heritage and the processes affecting it is incomplete and the full potential significance or value of natural heritage remains unknown because of this uncertain state of knowledge.
Private good	A good which, if consumed by one person, cannot be consumed by another person.
Property rights	Rights that govern the use and ownership of a resource – most commonly associated with the use and ownership of land.
Protection	Taking care of a place by maintenance and by managing impacts to ensure that natural significance is retained. (Australian Heritage Commission 1997)
Public good	A commodity whose benefits may be provided to all people at no more cost than that required to provide it for one person. The benefits are indivisible and no one can be excluded from using it.
Rare	A species that characteristically has a limited distribution and/or abundance due to the specificity of their habitat requirements or that has a limited distribution and abundance because habitat resources have been modified or lost. The term is used to describe taxa that are not threatened or vulnerable by definition, but are at risk due to the small population size and/or limited distribution.
Regeneration	The natural regeneration of vegetation contributes to vegetation cover when the dominant species of the pre-existing vegetation type re-establish, but are less than 10 years of age.
Regional Assessment Panel	The RAP is a community-based panel ministerially appointed (on the advice of the GBCMA) to review and prioritise Natural Heritage Trust bids in accordance with the priorities established in the <i>Catchment Strategy</i> and <i>Business Plan</i> .
Remnant vegetation	Areas of existing native vegetation that have not been planted, where the dominant species still remain and is greater than 10 years of age.
Revegetation	The deliberate planting of vegetation. Revegetation contributes to vegetation cover when the species composition and structure (i.e. all vegetation strata) is similar to pre-existing vegetation types for that area.
SIR	Shepparton Irrigation Region
Site plan	A plan detailing the attributes that require consideration as part of an application to destroy, remove or lop native vegetation.
Threatened	The generic term used to describe taxa that are rare, vulnerable, endangered or insufficiently known and are subject to threatening processes.
Timber harvesting	Ongoing timber extraction and production from native forest and plantations with follow-up regeneration works.
User pays	Pricing principle based on charging the user for the full supply cost of a product/resource.
VPP	Victoria Planning Provisions
VROTS	Victorian Rare or Threatened Species
Vulnerable	Species likely to become endangered in the short term (approximately 25 years) if threatening processes continue.

