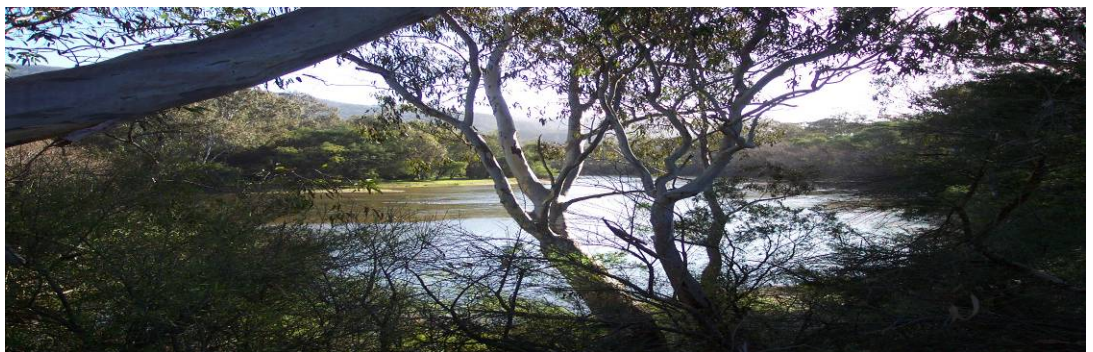


Goulburn Broken Regional River Health Strategy

Our Catchment – Status of the Riverine System

Waterways In Focus



2005

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Abbreviations used in this report

AROT	Australian Rare or Threatened
CAMBA	China-Australia Migratory Birds Agreement
DO	Dissolved Oxygen
DSE	Department of Sustainability and Environment
EC	Electrical Conductivity
EPA	Environment Protection Authority
EPBC	<i>Environment Protection and Biodiversity Conservation Act 1999</i>
EPT	Ephemeroptera, Plecoptera and Trichoptera
EVC	Ecological Vegetation Class
FFG	<i>Flora and Fauna Guarantee Act 1988</i>
GBCMA	Goulburn Broken Catchment Management Authority
GM	Goulburn Murray
ISC	Index of Stream Condition
JAMBA	Japan-Australia Migratory Birds Agreement
LCC	Land Conservation Council
NRE	Department of Natural Resources and Environment (now DSE)
O/E	Observed (divided by) Expected
RHWQC	River Health and Water Quality Committee
RiVERS	River Values and Environmental Risk System
SEPP	State Environment Protection Policy
SIGNAL	Stream Invertebrate Grade
VRHS	Victorian River Health Strategy (NRE, 2002)
VROT	Victorian Rare or Threatened
VWQMN	Victorian Water Quality Monitoring Network
WQ	Water Quality

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The Technical Panel responsible for the analysis and preparation of the draft strategy:

- Tim Doeg Macroinvertebrates (Senior Researcher)
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Also:

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Victorian Water Resources Data Warehouse: <http://www.vicwaterdata.net/>

Contents

1. INTRODUCTION.....	1
2. WATERWAYS IN FOCUS – THE GOULBURN BASIN.....	6
2.1 Management Unit L1 – Lower Goulburn and Floodplain.....	6
2.2 Management Unit L3 – Strathbogie Plains	12
2.3 Management Unit L4 – Western Catchment	18
2.4 Management Unit M7 – Euroa Strathbogie	23
2.5 Management Unit U1 – Mid Goulburn River	29
2.6 Management Unit U2 – Majors/Hughes Creek.....	35
2.7 Management Unit U3 – Sunday/Dry Creek	41
2.8 Management Unit U4 – King Parrot Creek/Yea River	47
2.9 Management Unit U5 – Northern tributaries	53
2.10 Management Unit U6 – Acheron, Rubicon and Taggerty Rivers	59
2.11 Management Unit U7 – Upper Goulburn Catchment	65
3. WATERWAYS IN FOCUS – THE BROKEN BASIN	71
3.1 Management Unit L2 – Lower Broken Creek.....	71
3.2 Management Unit L5 – Lower Broken River	77
3.3 Management Unit M1 – Mid Broken River	82
3.4 Management Unit M2 – Upper Broken River catchment	87
3.5 Management Unit M3 – Ryans and Hollands Creeks	93
3.6 Management Unit M4 – Lake Mokoan	99
3.7 Management Unit M5 – Warrenbayne Creek	102
3.8 Management Unit M6 – Upper Broken and Boosey Creeks.....	107
4. REFERENCES.....	113

1. Introduction

In the report entitled *Regional River Health Strategy (2004), Status of the Riverine System – Regional Overview*, a broad regional overview of the Basins was presented. In this report a closer examination of the catchment is provided by Management Unit.

Nineteen Management Units have been identified in the Goulburn Broken Catchment (Figure 1.1 and 1.2, Table 1.1). For each Management Unit, a summary of environmental, social and economic assets, and threats, is provided.

Table 1.1. Management Units in the Goulburn Broken Catchment.

Number	Name	Length (km)
Goulburn Basin		
L1	Lower Goulburn River and Floodplain	195.0
L3	Strathbogie Plains	227.5
L4	Western Catchment	152.5
M7	Euroa Strathbogie	100.0
U1	Mid Goulburn River	145.0
U2	Majors Creek and Hughes Creek	132.5
U3	Sunday/Dry Creeks	175.0
U4	King Parrot Creek/Yea River	167.5
U5	Northern tributaries	110.0
U6	Acheron, Rubicon and Taggerty Rivers	100.0
U7	Upper Goulburn catchment	200.0
Broken Basin		
L2	Lower Broken Creek	210.0
L5	Lower Broken River	62.5
M1	Mid Broken River	55.0
M2	Upper Broken River Catchment	52.5
M3	Ryans and Hollands Creeks	127.5
M4	Lake Mokoan	17.5
M5	Warrenbayne Creek	63.5
M6	Upper Broken and Boosey Creeks	200.0

Environmental assets can be assessed using two main types of measures – rarity (including representativeness) and naturalness. Rarity measures are those regarded as having special environmental significance (e.g. rare or endangered flora, fauna, representativeness¹). Naturalness measures assess environmental components in terms of their closeness to “natural”.

The measures of *environmental rarity* include threatened flora and fauna that are dependent on water or riparian habitats, wetlands and vegetation communities, as well as sites of special significance. Only Very High or High ratings are shown as these are the only categories of importance for this rating. Medium, Low and Very Low ratings are not shown for this category, as these lower ratings may imply less value for those regions (which is not true – they simply do not contain assets identified as having special significance).

¹ Representativeness refers to the selection of rivers or reaches that have been declared as “typical” of different bioregions across the state (and is here included in the rarity measures).

Figure 1.1 Map of the Goulburn River Basin showing the location of Management Units

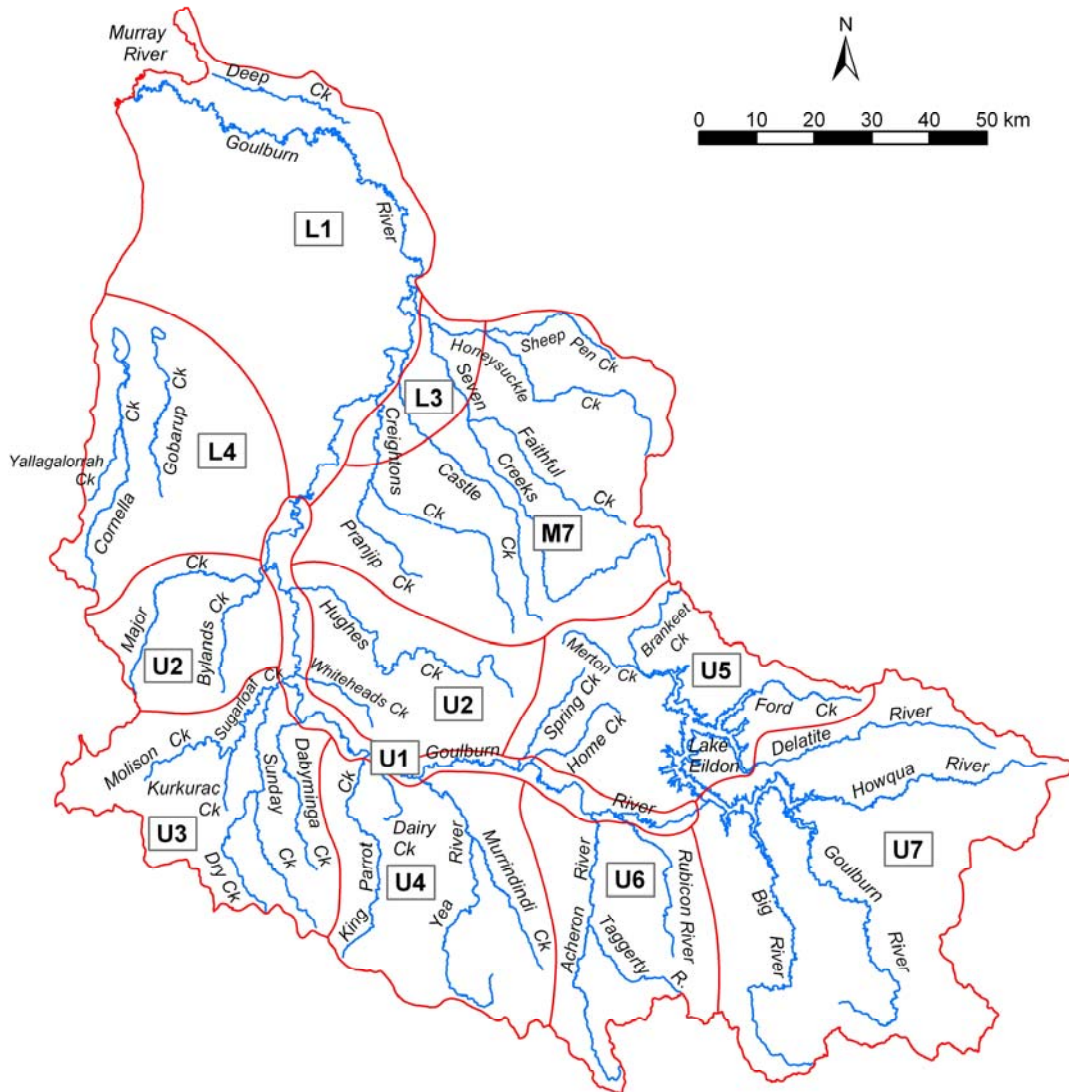
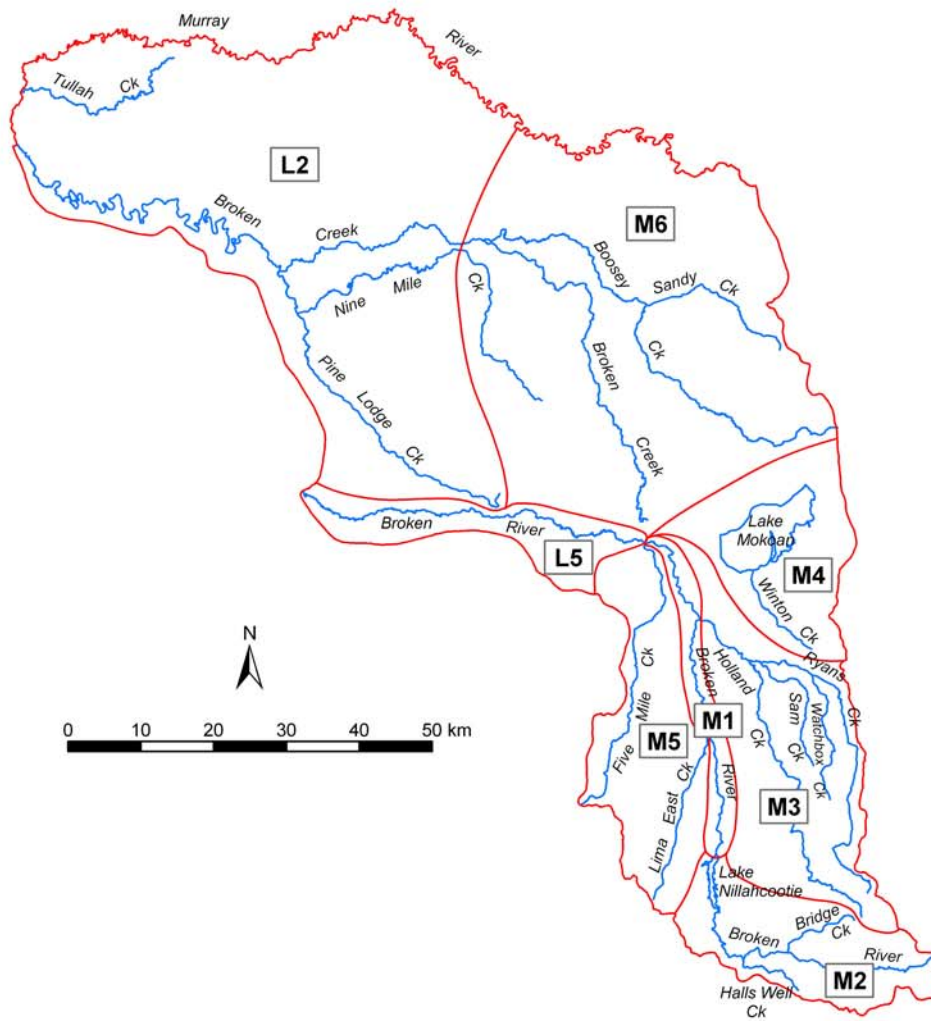


Figure 1.2 Map of the Broken River Basin showing the location of Management Units



The measures of *environmental naturalness* are composed of two different components – riparian vegetation condition (expressed as width, continuity and structural intactness) and the condition of the two main instream biological communities (invertebrates and fish). The degree of naturalness can be displayed as the proportion of stream/river length within the basins that have various rating of naturalness from Excellent to Very Poor, including reaches with no data.

Nine measures of **social assets** have been recorded for the Goulburn Broken Catchment, representing active recreation activities (fishing, sports, camping and swimming), cultural values (European Heritage, species of local significance² and listed landscapes), and passive recreation. Data for Social value were derived primarily from consultation with the local community of the catchments.

Six measures of **economic assets** have been recorded for the Goulburn Broken Catchment, representing water supply (both irrigation and potable related to collection and delivery), infrastructure, land value, tourism and power generation. Ratings of Very High and High value are based on specific criteria for each economic asset (Table 1.2).

Table 1.2. Criteria for Very High or High value rating for economic assets.

Measure	Criteria for Very High or High value
Water supply (delivery)	Registered extraction site and/or carries irrigation water, OR Providing water to potable water supply.
Water supply (collection)	Water supply protection area, OR Proclaimed water supply catchment.
Infrastructure	Sealed road/major instream structure/culvert bridge, OR Major highway/major bridge/fully lined channel.
Land value	Some irrigated land/broad acre cropping/mixed grazing, OR Irrigation – dairy, orchard, vineyard, intensive agriculture – or urban residential.
Tourism	Formal use by tourists, OR Areas with a tourism focus or formal tourist events.
Power generation	Major power facility.



Broken River / Lake Benalla
River reach of significant social and economic value

² Species of local significance are those that are valued by the local community for a variety of reasons. They are not necessarily rare or threatened in some formal sense (although some are), but represent a valued local biological asset.

Sixteen measures of **threat** have been recorded for the Goulburn Broken Catchment (Table 1.3). These represent changes to the physical nature of the channel, changes to the flow regime, changes to water quality and biological changes.

Table 1.3. Threat measures used in RiVERS.

Category	Measures and comments
Physical	<ul style="list-style-type: none"> • Bank erosion – ranges from stable to extremely unstable. • Bed instability – ranges from stable to extremely unstable. • Channel form – related to levels of channel realignment and de-snagging. • Instream habitat – ranges from very poor to excellent. • Stock access – either present or absent.
Flow	<ul style="list-style-type: none"> • Hydrology – based on hydrology deviation index used in the ISC. • Wetland connectivity – related to presence of riverine wetlands and degree of flooding compared to natural.
Water quality	<ul style="list-style-type: none"> • Water quality trend – measure of trend in water quality parameters (e.g. significant increase or decrease in levels over time). • Water quality level – based on whether SEPP objectives are attained for measures of phosphorus, nitrogen, turbidity, conductivity, dissolved oxygen and pH. • Water quality SIGNAL – using macroinvertebrates to estimate the biological impact of water quality³. • Temperature – only based on cold water dam releases, based on dam size and off-take level. • Algal blooms – either absent or known to have occurred.
Biological	<ul style="list-style-type: none"> • Exotic fauna – based on presence and abundance of terrestrial pests. • Exotic flora – percent cover of weeds in riparian vegetation. • Barriers – presence and severity of barriers to fish migration. • Streamside Zone – based on the ISC measure

³ The SIGNAL score is used in RiVERS as both a measure of an asset (part of the macroinvertebrate data) and as a measure of threat. As a threat, a low SIGNAL score represents a potential water quality threat. The SIGNAL score is used as an adjunct to the Water Quality level threat, as there are data on SIGNAL values in areas where no water quality data are available.

2. Waterways in Focus – The Goulburn Basin

2.1 Management Unit L1 – Lower Goulburn and Floodplain

Management Unit L1 – Lower Goulburn and Floodplain – covers the Goulburn River downstream of Goulburn Weir, a total length of stream of 195 km. Eight reaches have been identified that form the Management Unit.

2.1.1 Summary of Management Unit Values and Threats

The summary table for Environmental, Social and Economic values, and threat ratings for Management Unit L1 (Table 2.1) shows an overall rating for the Management Unit, based on a proportional (by reach length) average of all indices for each component, from the RiVERS database.

The Index of Stream Condition scores for each ISC sub-index (Hydrology, Physical Form, Streamside Zone, Water Quality and Aquatic Life) for each reach in the Management Unit is shown in Table 2.2. Where no value for a sub-index is given, there is insufficient data to evaluate that sub-index.

Table 2.1. Summary Table for Environmental, Social and Economic values, and for threat ratings for Management Unit L1.

Environmental	Social	Economic	Threat
High	High	Moderate	Moderate

Table 2.2. Index of Stream Condition Scores for reaches in Management Unit L1.

Reach	Stream Name	Hydrology	Physical Form	Streamside Zone	Water Quality	Aquatic Life
1	Goulburn River	0	8	8	6	
2	Goulburn River	0	7	8	7	6
3	Goulburn River	0	6	8		8
4	Goulburn River	0	6	8	9	
5	Goulburn River	0	6	7	8	
6	Goulburn River	0	7	8		6
7	Goulburn River	0	7	8	10	
8	Goulburn River	0	8	7	9	4
	Average	0.0	6.9	7.8	8.2	6.0

2.1.2 Environmental values in Management Unit L1

Rarity

The Lower Goulburn and Floodplain Management Unit (L1) has a high or very high rarity rating over much of its length for a number of different values (Figure 2.1)⁴. The entire length is a declared Heritage River (LCC, 1991), all reaches have significant faunal species within 100m of the river (Table 2.3). Significant Ecological Vegetation Classes (EVC) and nationally important wetlands are also found throughout the Management Unit (Figure 2.1).

⁴ Environmental values that denote Environmental Rarity are taken from the VRHS. Measures of Very High and High are denoted by a score greater than 3 in RiVERS.

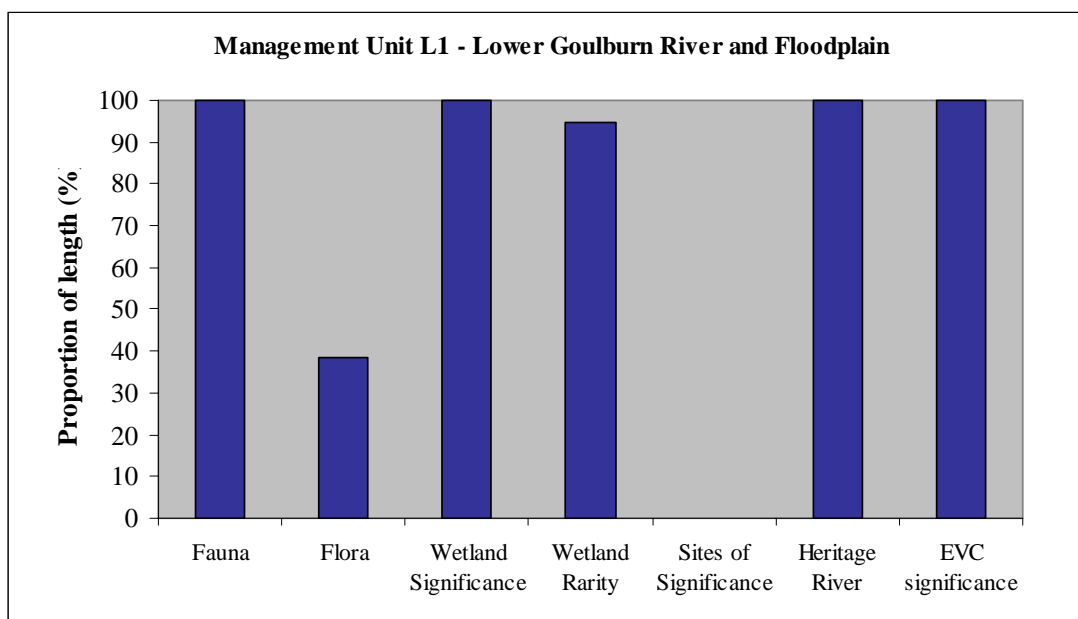


Figure 2.1. Proportion of stream length in Management Unit L1 with High or Very High Environmental Rarity rating.

Table 2.3. Significant fauna, flora and EVC in Management Unit L1.

Fauna	
<ul style="list-style-type: none"> • Bandy bandy • Barking owl • Brown quail • Brush-tailed phascogale • Crimson-spotted rainbowfish • Golden perch • Great egret • Murray cod 	<ul style="list-style-type: none"> • Painted honeyeater • Powerful owl • Royal spoonbill • Squirrel glider • Warty bell frog • White-bellied sea-Eagle • Woodland blind snake
Flora	
<ul style="list-style-type: none"> • Silky browntop • Swamp billy-buttons • Veiled fringe-sedge 	<ul style="list-style-type: none"> • Short-awned wheat-grass • Veiled fringe-sedge
EVC	
<ul style="list-style-type: none"> • Black Box Chenopod Woodland • Floodplain Riparian Woodland • Pine Box Woodland/Riverina Plains Grassy Woodland Mosaic • Plains Grassy Woodland • Riverine Grassy Woodland • Riverine Grassy Woodland/Gilgai Plain Woodland/Wetland/Riverina Plains Grassy Woodland 	<ul style="list-style-type: none"> • Riverine Grassy Woodland/Riverina Plains Grassy Woodland Complex • Riverine Grassy Woodland/Riverina Plains Grassy Woodland/Black Box Chenopod Woodland Complex • Riverine Grassy Woodland/Riverine Sedgy Forest/Wetland Mosaic • Sand Ridge Woodland

Naturalness

In this Management Unit, most of the length has a Good native fish community composition (i.e. most of the expected species have been recorded there) but exotic fish are also common throughout (designated by the Poor value for Exotic Fish Proportion - Figure 2.2). Riparian width, continuity and structure is Excellent or Good throughout the whole Management Unit, although not all structural elements of the riparian vegetation are as expected (Riparian Intactness is Moderate to Poor). Macroinvertebrate communities are only Moderate to Poor in all reaches where there is data.

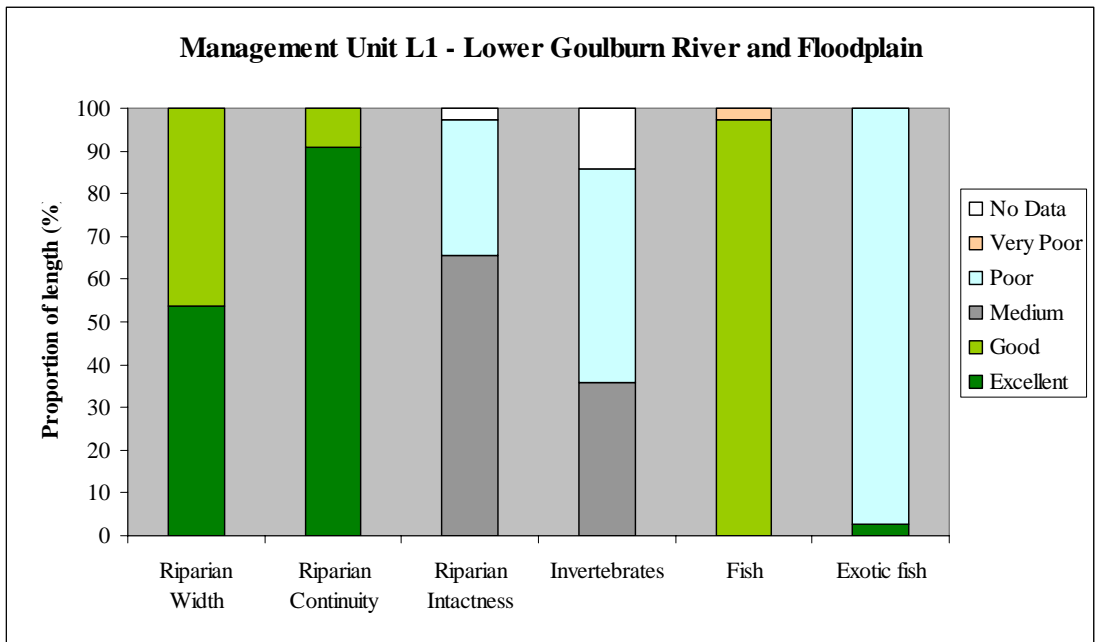


Figure 2.2. Proportion of stream length in Management Unit L1 with various Environmental Naturalness rating.



Goulburn River (Reach 1)

2.1.3 Social Values

High social values in the Management Unit mainly include fishing, motor sports and camping which are popular throughout (either seasonal or through the year - Figure 2.3). A number of species of local significance species (those with special community significance rather than necessarily of conservation significance) are also known to inhabit the Management Unit (Table 2.4).

Table 2.4. Species of local significance found in Management Unit L1.

Billy buttons	Koala	Silver wattle
Brushtail phascogale	Murray cod	Spiny freshwater crayfish
Cockatoo	Murray crayfish	Squirrel glider
Corella	Platypus	Straw-necked ibis
Golden perch	River redgum	Tiger snake
Grey crown babbler	Sacred ibis	Trout cod
Kingfisher	Silver perch	Wedge-tailed eagle

2.1.4 Economic values

The main high or very high economic values in Management Unit L1 come from irrigation water supply and infrastructure (Figure 2.4). Land value is high in the upper parts of the Management Unit.

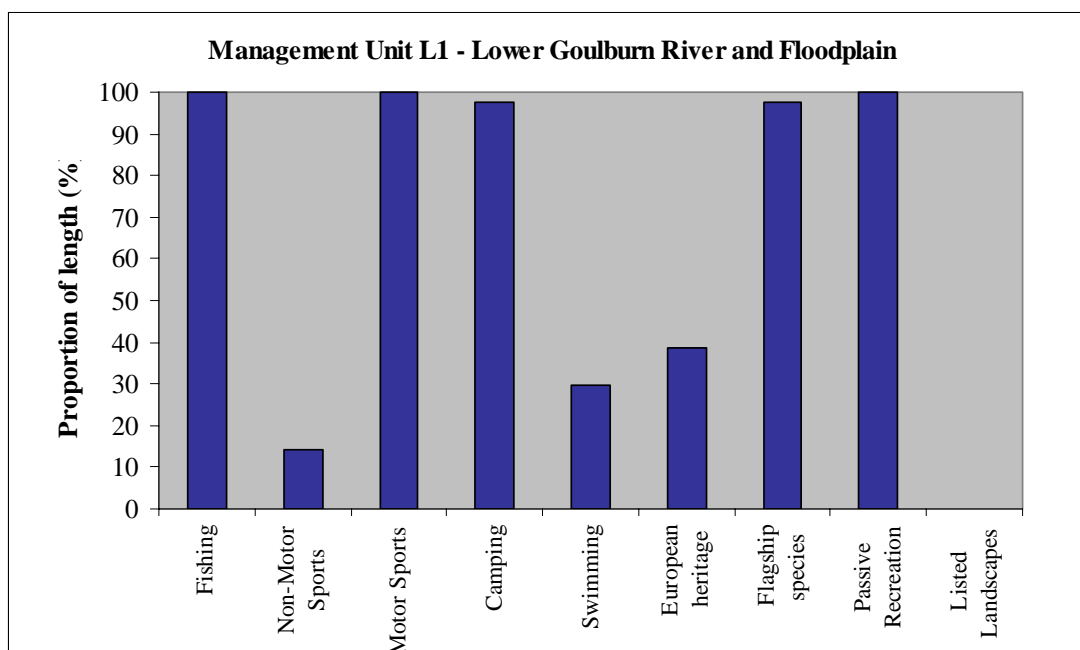


Figure 2.3. Proportion of stream length in Management Unit L1 with Very High or High Social value rating.

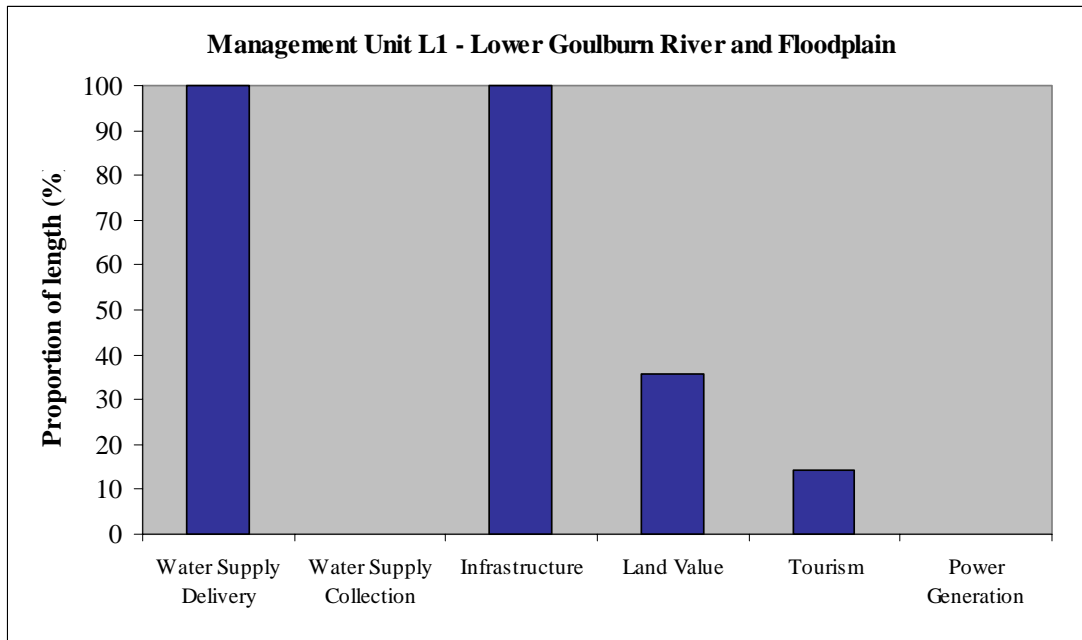
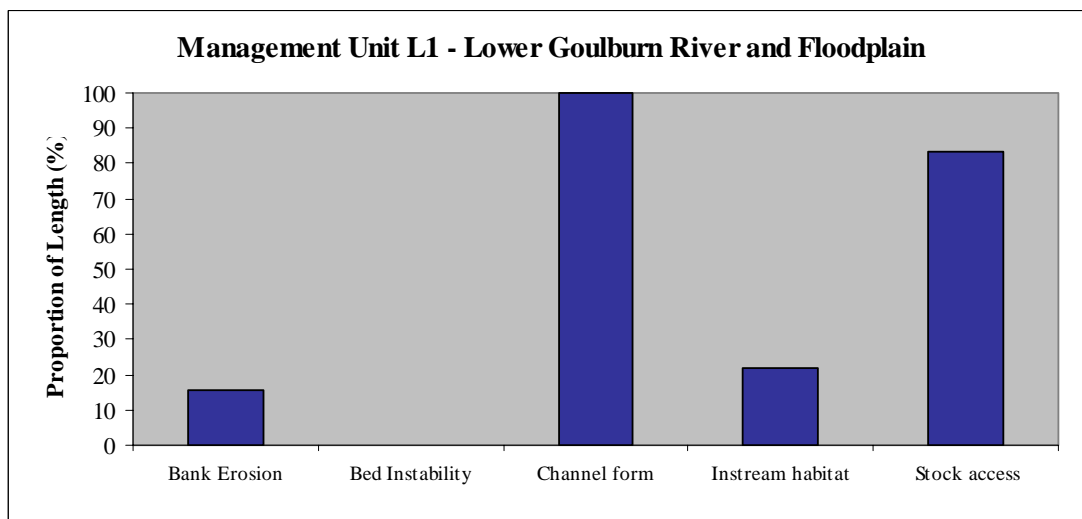


Figure 2.4. Proportion of stream length in Management Unit L1 with Very High or High Economic value rating.

2.1.5 Threats

High or Very High physical threats in Management Unit L1 come mainly from channel modification (over the entire Management Unit) and stock access (noted along 83% of the Management Unit - Figure 2.5). Flow deviation is high over the entire Management Unit, and water quality measures (trend, level and SIGNAL) are generally poor where there is data available, with water quality failing more than 2 SEPP Waters of Victoria measures at 2 sites (Table 2.5). No threats from introduced terrestrial flora, barriers or degraded riparian vegetation were noted (although little data on exotic fauna is available).



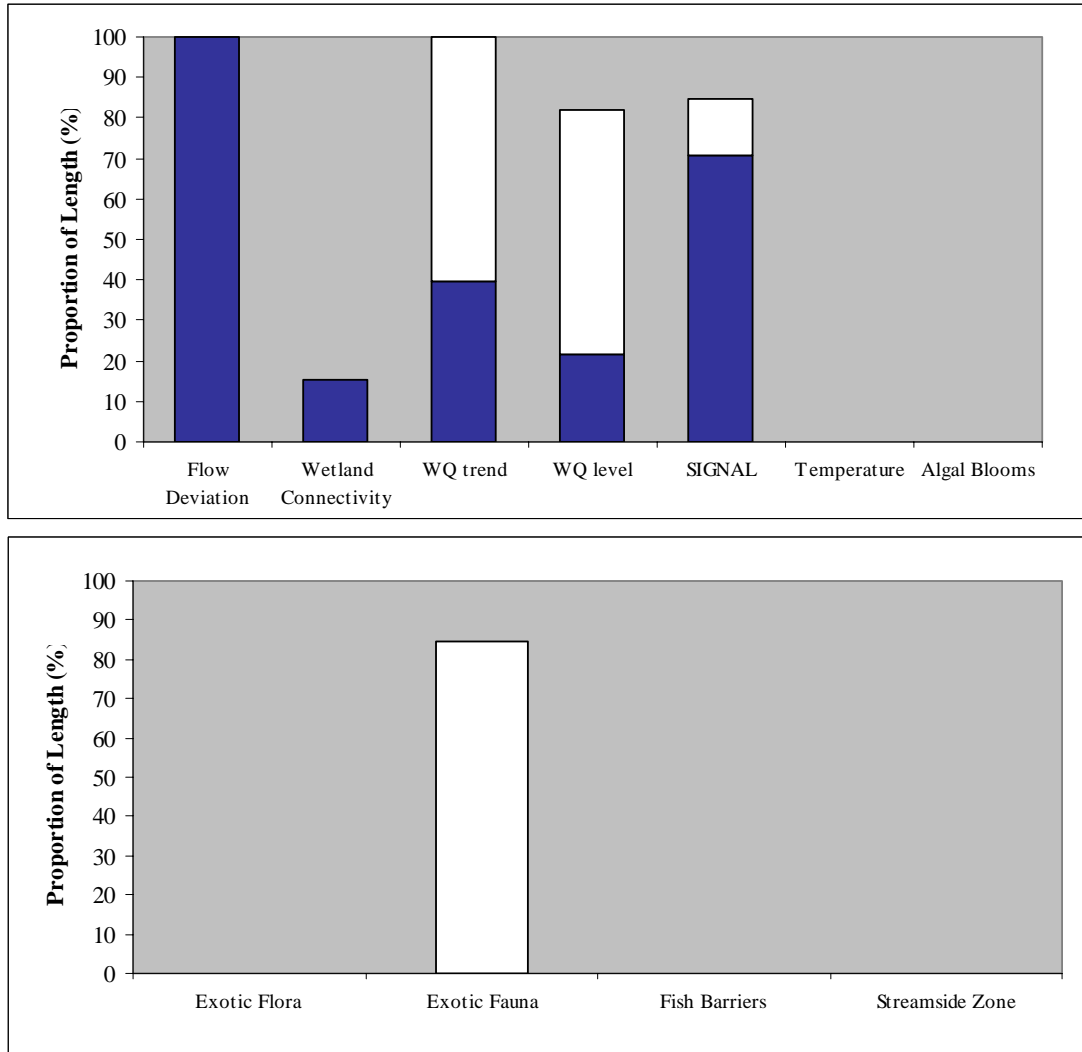


Figure 2.5. Proportion of stream length in Management Unit L1 with Very High or High Threat ratings for Physical (top), Flow and Chemical (middle) and Biological (bottom) components. Blank – No data.

Table 2.5. Attainment of SEPP objectives for 6 water quality parameters in Management Unit L1 VWQMN sites. ✘ - not attained, ✓ - attained, blank – insufficient data.

VWQMN Site code	Location	Nitrogen	Phosphorous	DO	pH	Turbidity	EC
405200	Goulburn River at Murchison	✓	✓	✘	✓	✓	✓
405204	Goulburn River at Shepparton	✓	✘	✘	✓	✓	✓
405232	Goulburn River at McCoy Bridge	✘	✘	✓	✓	✘	✓

2.2 Management Unit L3 – Strathbogie Plains

Management Unit L3 – Strathbogie Plains – covers the eastern tributaries that flow into the Goulburn River downstream of Goulburn Weir, a total length of stream of 227.5 km. Ten reaches have been delineated that form the Management Unit (including one urban reach not included in the ISC).

2.2.1 Summary of Management Unit Values and Threats

The summary table for Environmental, Social and Economic values, and threat ratings for Management Unit L3 (Table 2.6) shows an overall rating for the Management Unit, based on a proportional (by reach length) average of all indices for each component from the RiVERS database.

The Index of Stream Condition scores for each ISC sub-index (Hydrology, Physical Form, Streamside Zone, Water Quality and Aquatic Life) for each reach in the Management Unit is shown in Table 2.7. Where no value for a sub-index is given, there is insufficient data to evaluate that sub-index.

Table 2.6. Summary environmental, Social and Economic values from RiVERS, and for threat ratings for Management Unit L3.

Environmental	Social	Economic	Threat
Low	Low	Moderate	Low

Table 2.7. Index of Stream Condition Scores for reaches in Management Unit L3.

Reach	Stream Name	Hydrology	Physical Form	Streamside Zone	Water Quality	Aquatic Life
17	Seven Creeks	8	6	5		8
18	Seven Creeks	8	5	4		8
21	Faithfull Creek	10	5	3		
22	Honeysuckle Creek	10	5	5		8
23	Honeysuckle Creek	9	5	4		
24	Sheep Pen Creek	10	4	3		
25	Castle Creek	6	6	5	8	8
27	Creightons Creek	10	7	5		8
29	Pranjip Creek	10	7	5		
	Average	9.0	5.6	4.3	8.0	8.0

2.2.2 Environmental values

Rarity

The Strathbogie Plains Management Unit (L3) has a Very High or High rarity rating over much of its length for a number of different values (Figure 2.6). In particular, the entire length has significant Ecological Vegetation Classes (EVC), and almost 80% of the length has significant faunal species within 100m of the river (Table 2.8) and 61% of the length rates highly for wetland rarity.

There are no Representative Rivers listed identified in the Management Unit.

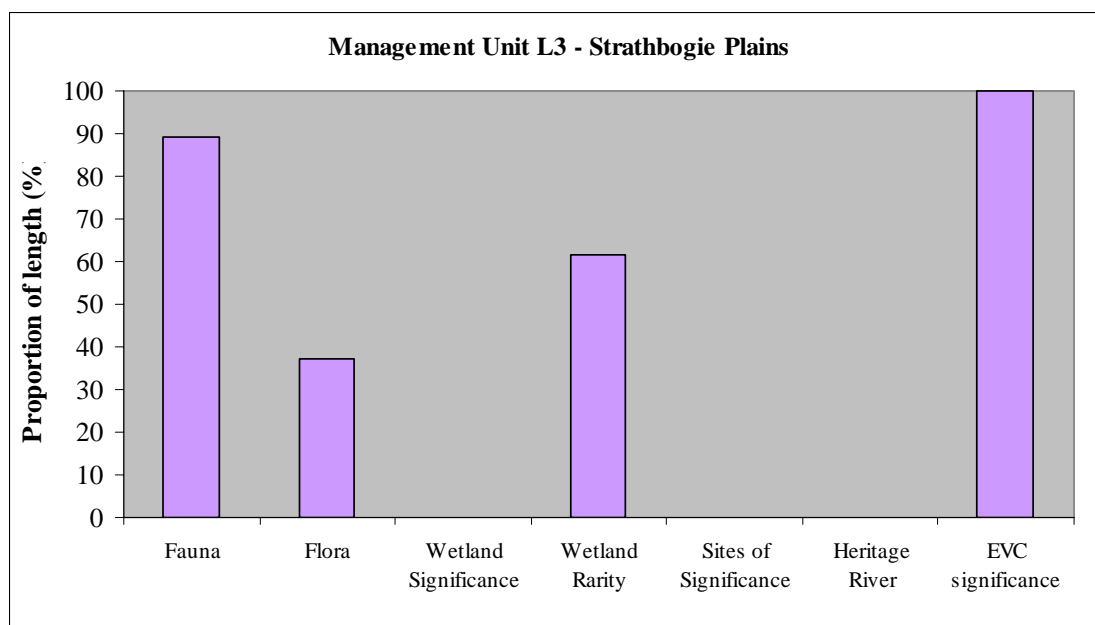


Figure 2.6. Proportion of stream length in Management Unit L3 with Very High or High Environmental Rarity rating.

Table 2.8. Significant fauna, flora and EVC in Management Unit L3.

Fauna	
<ul style="list-style-type: none"> Bush stone-curlew Golden perch Great egret Grey-crowned babbler Mountain galaxias 	<ul style="list-style-type: none"> Silver perch Southern myotis Swift parrot Tree goanna Nankeen night heron
Flora	
<ul style="list-style-type: none"> Late-flower flax-lily Sand rush Short-awned wheat-grass 	<ul style="list-style-type: none"> Silky browntop Spurred spear-grass Swamp billy-buttons
EVC	
<ul style="list-style-type: none"> Alluvial Terraces Herb-rich Woodland/Creepline Grassy Woodland Mosaic Box Ironbark Forest Creepline Grassy Woodland Drainage Line Complex Floodplain Riparian Woodland Gilgai Plain Woodland/Wetland Mosaic Grassy Dry Forest 	<ul style="list-style-type: none"> Grassy Woodland Herb-rich Foothill Forest Plains Grassy Woodland Red Gum Wetland Riparian Forest Riverine Grassy Woodland/Riverine Sedgy Forest/Wetland Mosaic Valley Grassy Forest

Naturalness

Riparian width, continuity and intactness are Medium to Very Poor over the entire Management Unit (Figure 2.7). Few invertebrate data is available, but only a few of the sites examined (Castle Creek) complied with the SEPP Waters of Victoria biological requirements. Native fish communities are close to those expected in Sevens and Pranjip Creeks (33% of the length of the Management Unit), although introduced species are common.

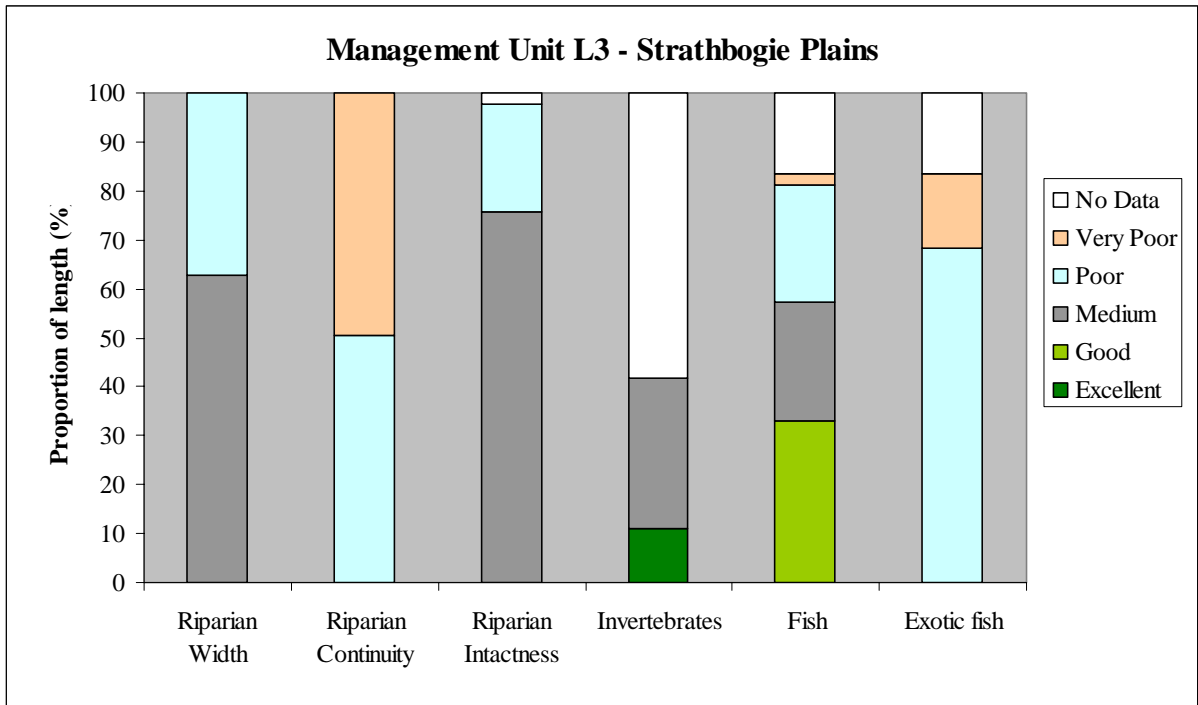


Figure 2.7. Proportion of stream length in Management Unit L3 with various Environmental Naturalness rating.



Seven Creeks (Reach 17)

2.2.3 Social Values

Few social values in the Management Unit rate highly - Figure 2.8), except for the number of species of local significance that are known throughout the Management Unit (Table 2.9) .

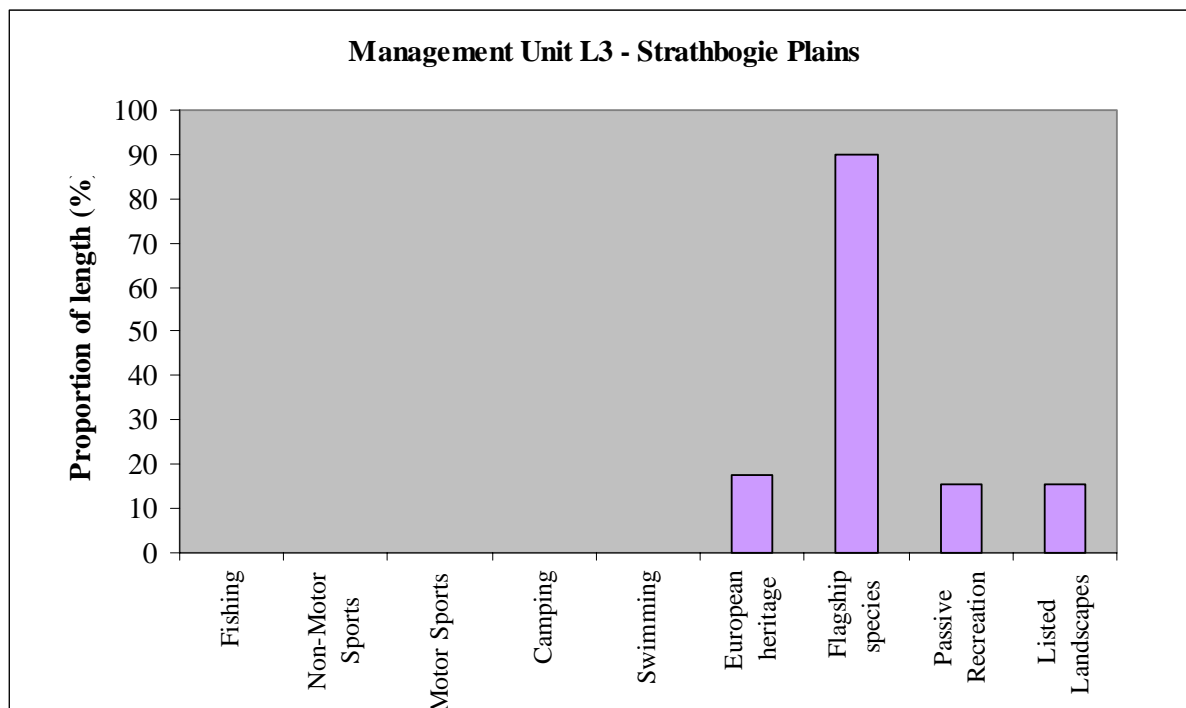


Figure 2.8. Proportion of stream length in Management Unit L3 with Very High or High Social value rating.

Table 2.9. Species of local significance found in Management Unit L3.

Golden perch	Platypus
Grey crown babbler	River Blackfish
Koala	Trout cod

2.2.4 Economic values

The main Very High or High economic values in Management Unit L3 come from irrigation water supply, infrastructure and land value (Figure 2.4).

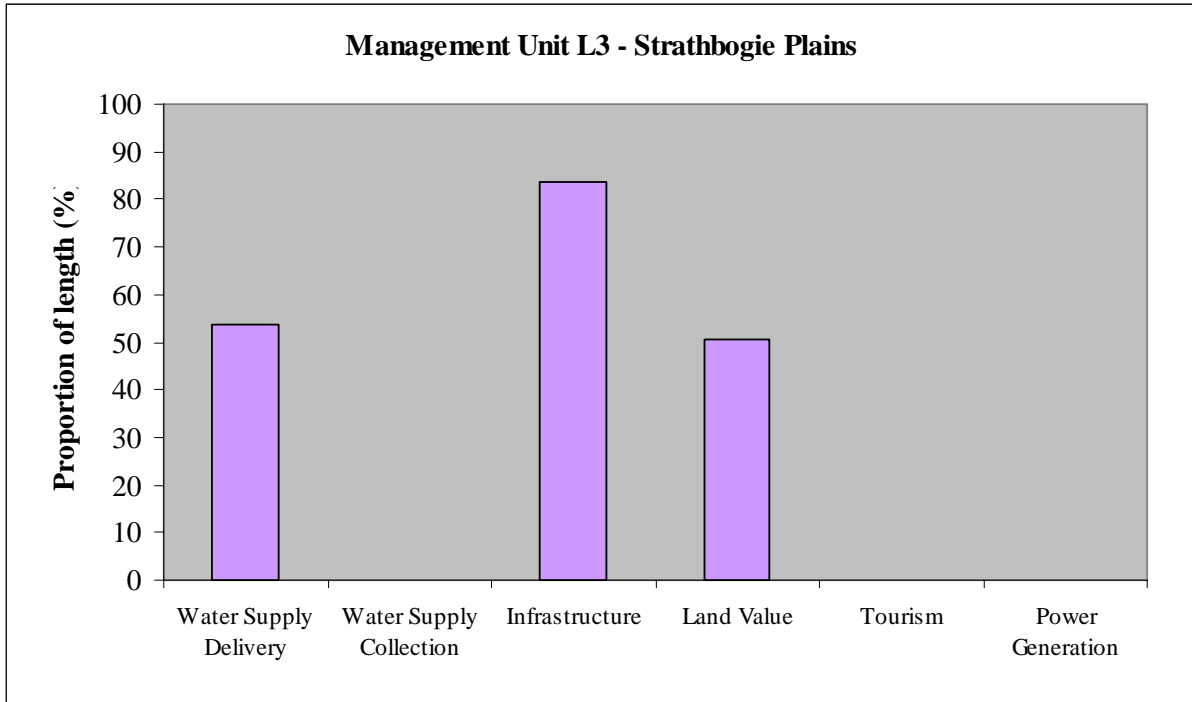


Figure 2.9. Proportion of stream length in Management Unit L3 with Very High or High Economic value rating.



Pranjip Creek (Reach 29)

2.2.5 Threats

Stock access is the main physical threat in the Management Unit (Figure 2.10), noted along the entire length. Other physical threats are uncommon. Flow deviation is not a serious threat. There is little data for water quality parameters. Riparian vegetation is degraded along almost half of the length of the Management Unit.

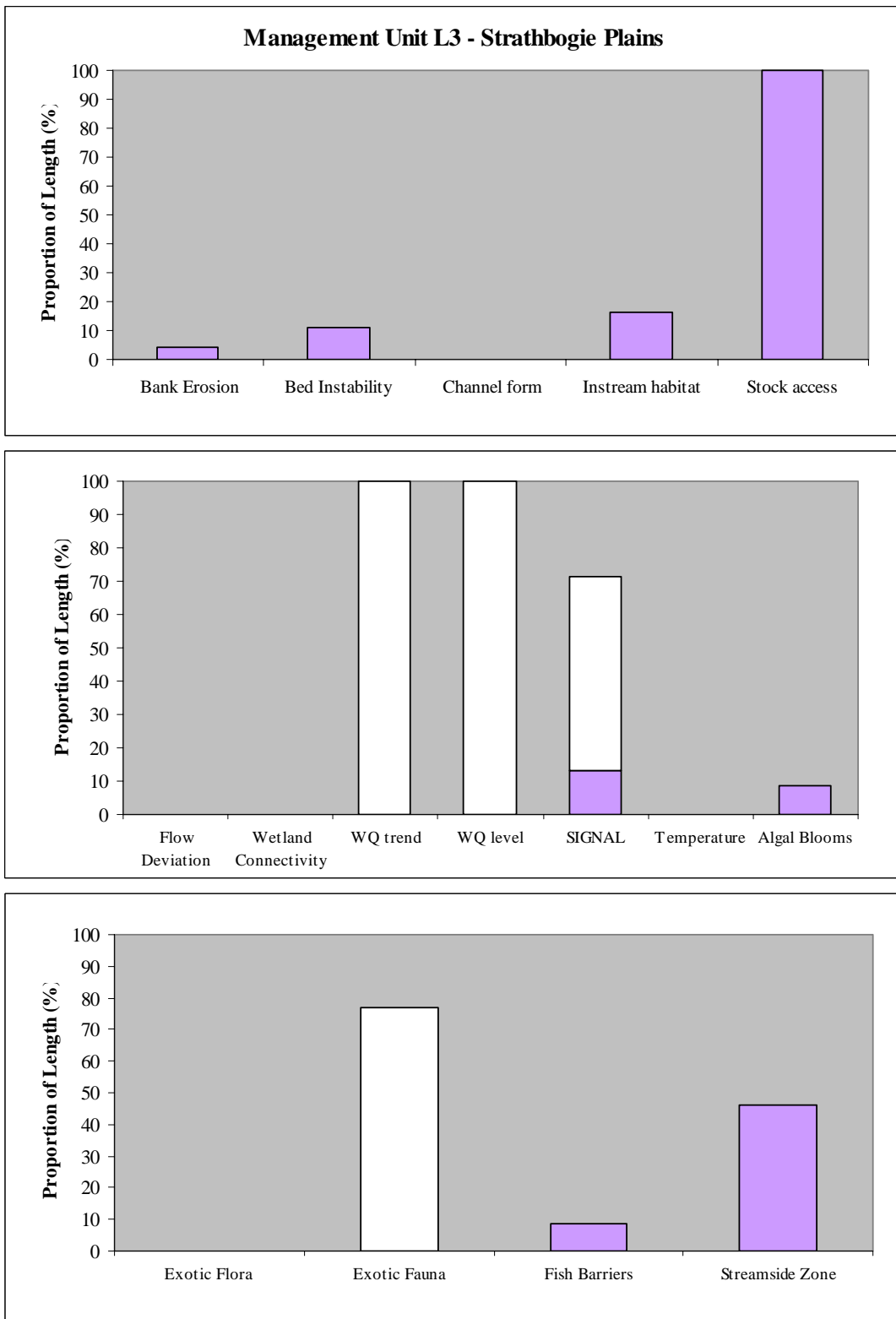


Figure 2.10. Proportion of stream length in Management Unit L3 with Very High or High Threat ratings for Physical (top), Flow and Chemical (middle) and Biological (bottom) components. Blank – No data.

2.3 Management Unit L4 – Western Catchment

2.3.1 Summary of Management Unit Values and Threats

The summary table for Environmental, Social and Economic values, and threat ratings for Management Unit L4 (Table 2.10) shows an overall rating for the Management Unit, based on a proportional (by reach length) average of all indices for each component from the RiVERS database.

The Index of Stream Condition scores for each ISC sub-index (Hydrology, Physical Form, Streamside Zone, Water Quality and Aquatic Life) for each reach in the Management Unit is shown in Table 2.11. Where no value for a sub-index is given, there is insufficient data to evaluate that sub-index.

Table 2.10. Summary Table for Environmental, Social and Economic values, and for threat ratings for Management Unit L4.

Environmental	Social	Economic	Threat
Low	Low	Moderate	Low

Table 2.11. Index of Stream Condition Scores for reaches in Management Unit L4.

Reach	Stream Name	Hydrology	Physical Form	Streamside Zone	Water Quality	Aquatic Life
30	Cornella Creek	10	5	5		
31	Cornella Creek	10	5	6		
34	Deep Creek	10	3	5		
33	Goborup Creek	10	6	6		
32	Yallagalorrah Creek	10	7	5		
	Average	10.0	5.2	5.4	n.a.	n.a.

2.3.2 Environmental values

Rarity

The Western Catchment Management Unit (L4) has a high or very high rarity rating over much of its length for both significant faunal species and significant Ecological Vegetation Classes (EVC) (Figure 2.11, Table 2.12). Nationally significant wetlands are located near Goborup Creek.

There are no representative rivers listed in the Management Unit.



Cornella Creek (Reach 31)

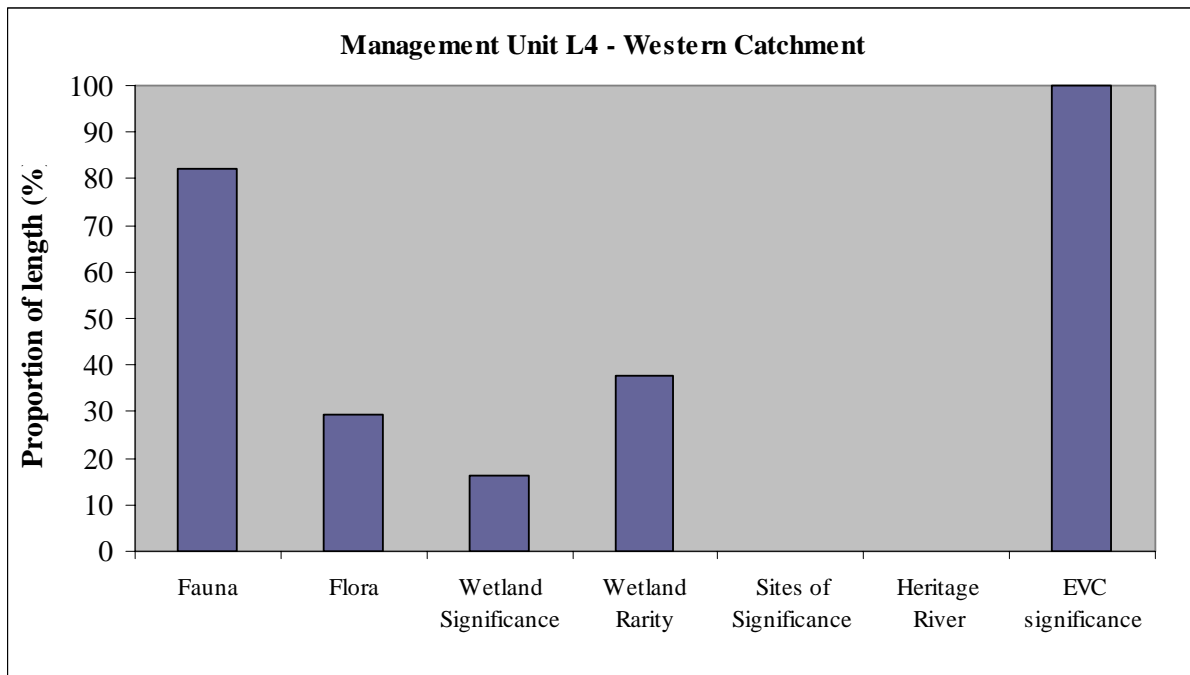


Figure 2.11. Proportion of stream length in Management Unit L4 with Very High or High Environmental Rarity rating.

Table 2.12. Significant fauna, flora and EVC in Management Unit L4.

Fauna	
<ul style="list-style-type: none"> • Australasian bittern • Australasian shoveler • Barking marsh frog • Diamond firetail • Great egret • Hardhead • Mountain galaxias 	<ul style="list-style-type: none"> • Musk duck • Royal spoonbill • Speckled warbler • Tree goanna • White-bellied sea-Eagle • Woodland blind snake
Flora	
<ul style="list-style-type: none"> • Ausfeld's wattle 	
EVC	
<ul style="list-style-type: none"> • Box Ironbark Forest • Brackish Lake • Creekline Grassy Woodland • Drainage Line Complex • Grassy Woodland • Plains Grassland/Gilgai Plain Woodland/Wetland Mosaic • Plains Grassy Woodland • Red Gum Wetland • Red Gum Wetland/Plains Grassy Wetland Mosaic 	<ul style="list-style-type: none"> • Riverine Grassy Woodland/Gilgai Plain Woodland/Wetland/Riverina Plains Grassy Woodland • Riverine Grassy Woodland/Riverina Plains Grassy Woodland Complex • Riverine Grassy Woodland/Riverina Plains Grassy Woodland/Black Box Chenopod Woodland Complex • Riverine Grassy Woodland/Riverine Sedgy Forest/Wetland Mosaic • Wetland Formation • Riverina Plains Grassy Woodland/Plains Grassland/Gilgai Plain Woodland/Wetland Mosaic

Naturalness

Of the naturalness measures, only riparian continuity is rated Excellent or Good over any of the Management Unit (Figure 2.12) . No invertebrate data is available. Native fish communities not close to those expected in any place where there is data, and introduced species are common.

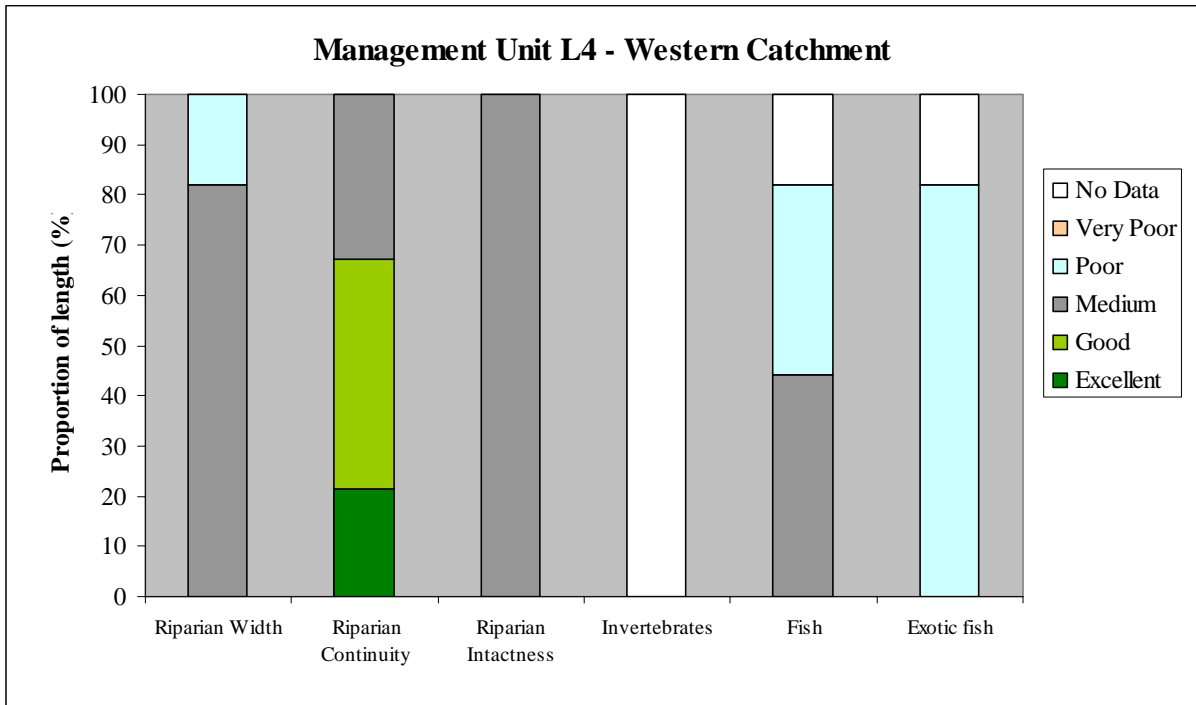


Figure 2.12. Proportion of stream length in Management Unit L4 with various Environmental Naturalness rating.

2.3.3 Social Values

Few social values in the Management Unit rate highly (Figure 2.13) apart from a number of European Heritage sites scattered throughout. A number of species of local significance are identified throughout the Management Unit (Table 2.13) .

Table 2.13. Species of local significance found in Management Unit L4.

Black duck	Grey teal
Brolga	Murray cod
Brush-tail phascogale	River Blackfish
Bush Stone curlew	Squirrel glider
Goanna	Yabbie

2.3.4 Economic values

The Western catchment has high economic values for Land Value (Figure 2.9) with 70% of the length of the Management Unit under high value irrigation crops. Deep Creek and Gaborup Creek are high value water delivery reaches, and tourism is a focus in Deep Creek.

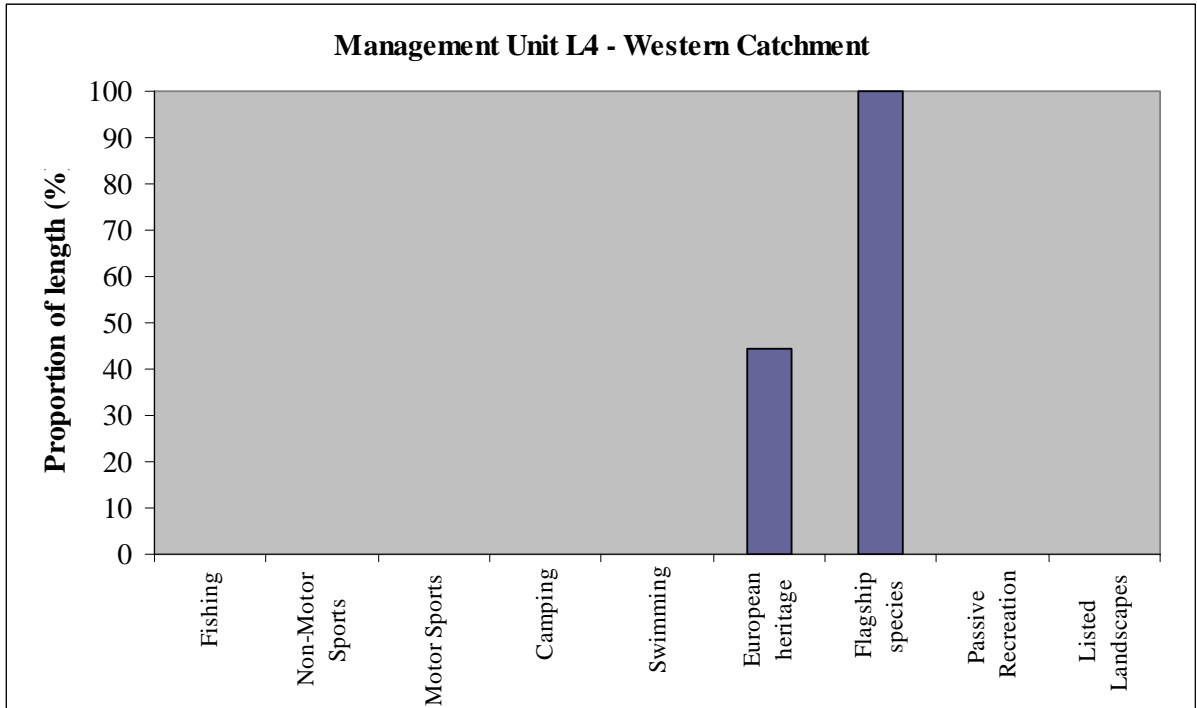


Figure 2.13. Proportion of stream length in Management Unit L4 with Very High or High Social value rating.

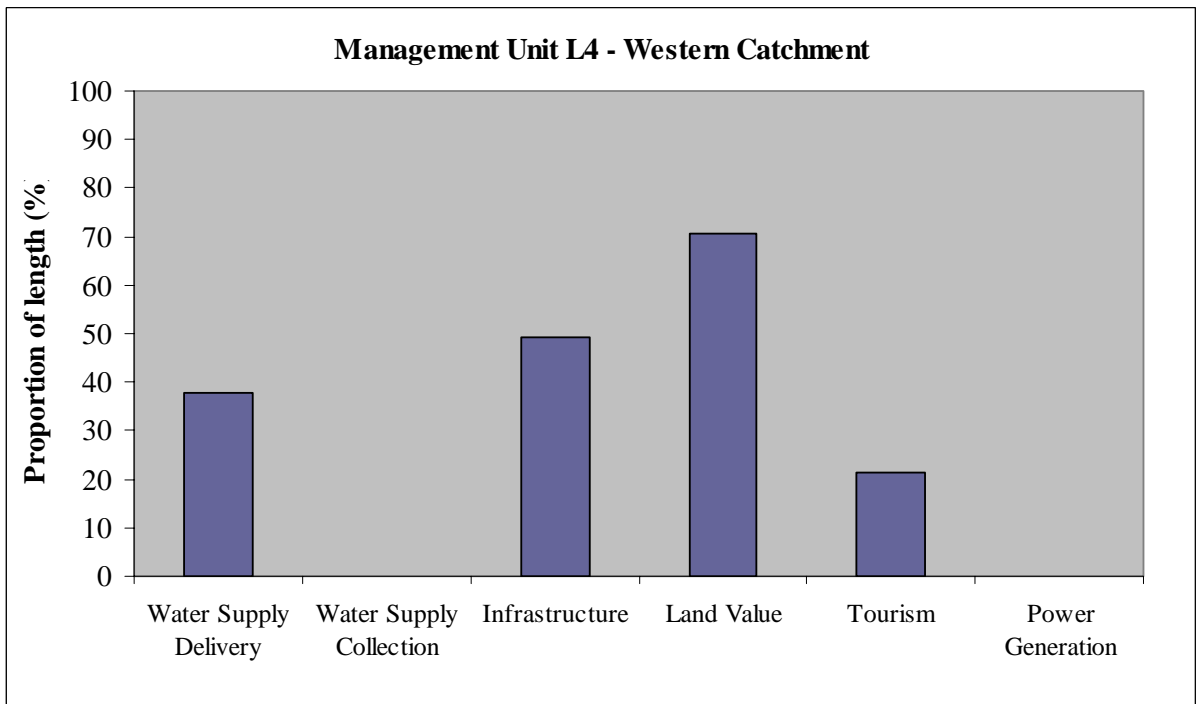


Figure 2.14. Proportion of stream length in Management Unit L4 with Very High or High Economic value rating.

2.3.5 Threats

Stock access and the loss of instream habitat are the main physical threat in the Management Unit (Figure 2.15), noted along 78% and 33% of the length respectively. Other physical threats are uncommon. Flow deviation, temperature and conditions for algal blooms are not a threat, but there is no water quality data. No biological threats are present, although there is no data on exotic fauna.

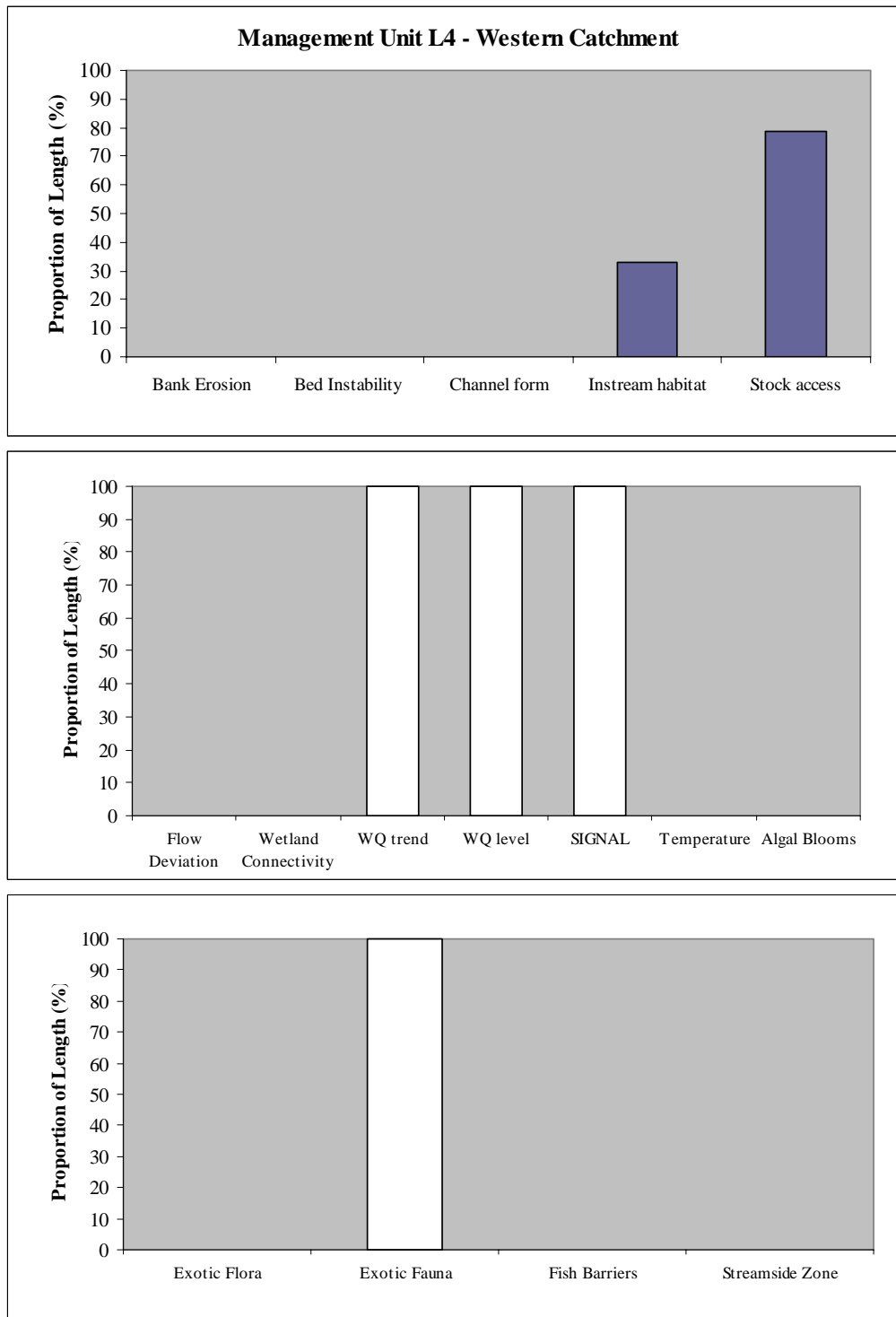


Figure 2.15. Proportion of stream length in Management Unit L4 with Very High or High Threat ratings for Physical (top), Flow and Chemical (middle) and Biological (bottom) components. Blank – No data.

2.4 Management Unit M7 – Euroa Strathbogie

Management Unit M7 – Euroa Strathbogie– covers the upper sections of eastern tributaries that flow into the Goulburn River downstream of Goulburn Weir, a total length of stream of 100 km. Four reaches have been delineated that form the Management Unit (including one urban reach – Euroa - not included in the ISC).

2.4.1 Summary of Management Unit Values and Threats

The summary table for Environmental, Social and Economic values, and threat ratings for Management Unit M7 (Table 2.14) shows an overall rating for the Management Unit, based on a proportional (by reach length) average of all indices for each component from the RiVERS database.

The Index of Stream Condition scores for each ISC sub-index (Hydrology, Physical Form, Streamside Zone, Water Quality and Aquatic Life) for each reach in the Management Unit is shown in Table 2.15. Where no value for a sub-index is given, there is insufficient data to evaluate that sub-index.

Table 2.14. Summary Table for Environmental, Social and Economic values, and for threat ratings for Management Unit M7.

Environmental	Social	Economic	Threat
Low	Moderate	Moderate	Moderate

Table 2.15. Index of Stream Condition Scores for reaches in Management Unit M7.

Reach	Stream Name	Hydrology	Physical Form	Streamside Zone	Water Quality	Aquatic Life
26	Castle Creek	9	5	4		9
28	Creightons Creek	10	5	4		9
19	Seven Creeks	10	4	5	6	9
20	Seven Creeks	10	6	5	8	
	Average	9.8	5.0	4.5	7.0	9.0

2.4.2 Environmental values

Rarity

The Euroa Strathbogie Management Unit (M7) has a high or very high rarity rating over much of its length for both significant faunal species and significant Ecological Vegetation Classes (EVC) (Figure 2.16, Table 2.16). One reach in Seven Creeks is listed as a Site of Significance for the Gooram Falls rock structures.

There are no representative rivers listed in the Management Unit.

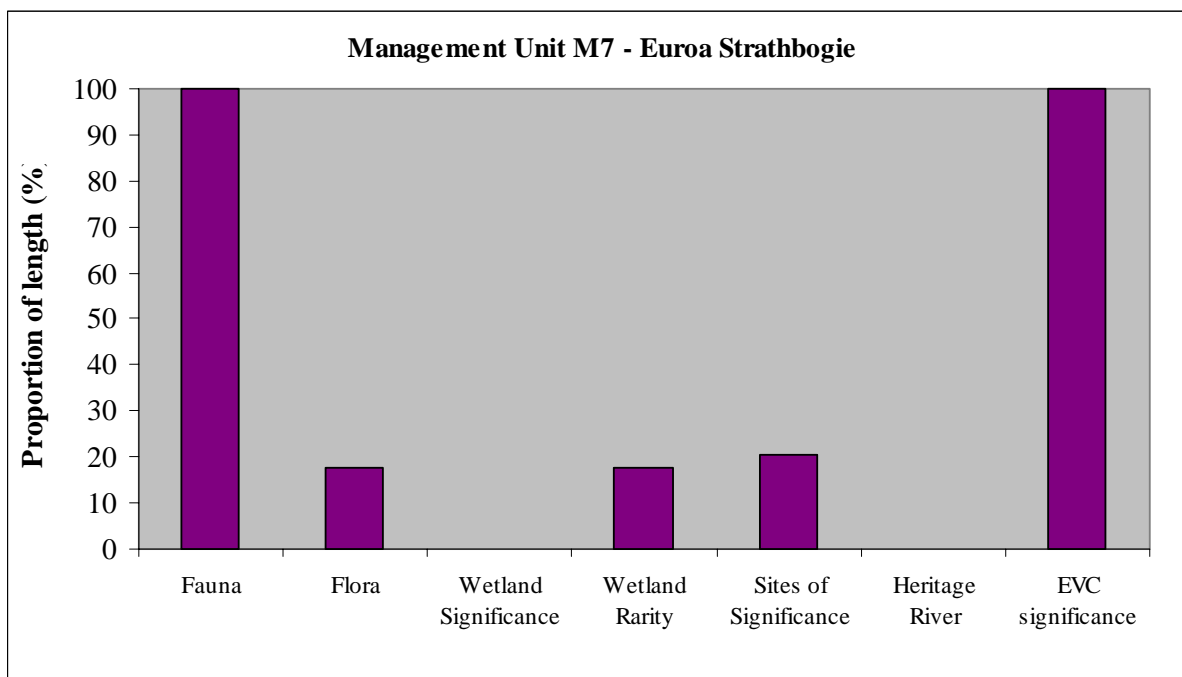


Figure 2.16. Proportion of stream length in Management Unit M7 with Very High or High Environmental Rarity rating.

Table 2.16. Significant fauna, flora and EVC in Management Unit M7.

Fauna	
<ul style="list-style-type: none"> • Bluenose (Trout) cod • Flat-headed galaxias • Glossy ibis • Golden perch • Great egret • Hardhead 	<ul style="list-style-type: none"> • Hooded robin • Macquarie perch • Mountain galaxias • Musk duck • Nankeen night heron • Powerful owl
Flora	
<ul style="list-style-type: none"> • Green-top sedge 	<ul style="list-style-type: none"> • Highland bush-pea
EVC	
<ul style="list-style-type: none"> • Creekline Grassy Woodland • Damp Forest • Floodplain Riparian Woodland • Grassy Dry Forest • Grassy Woodland • Herb-rich Foothill Forest • Perched Boggy Shrubland Complex • Riparian Forest/Swampy Riparian Woodland/Riparian Shrubland/Riverine Escarpment Scrub/Disturbed Mosaic 	<ul style="list-style-type: none"> • Riparian Shrubland • Riverine Escarpment Scrub • Swampy Riparian Woodland • Swampy Riparian Woodland/Perched Boggy Shrubland Mosaic • Valley Grassy Forest • Valley Grassy Forest/Plains Grassy Woodland Complex • Plains Grassy Woodland

Naturalness

No riparian vegetation measures are better than Moderate over the entire Management Unit (Figure 2.17). There is limited invertebrate data available, with only Creightons Creek site achieving SEPP achievement (20% of the Management Unit length). Native fish communities are close to those expected only in the upper Seven Creeks, and introduced species are common throughout.

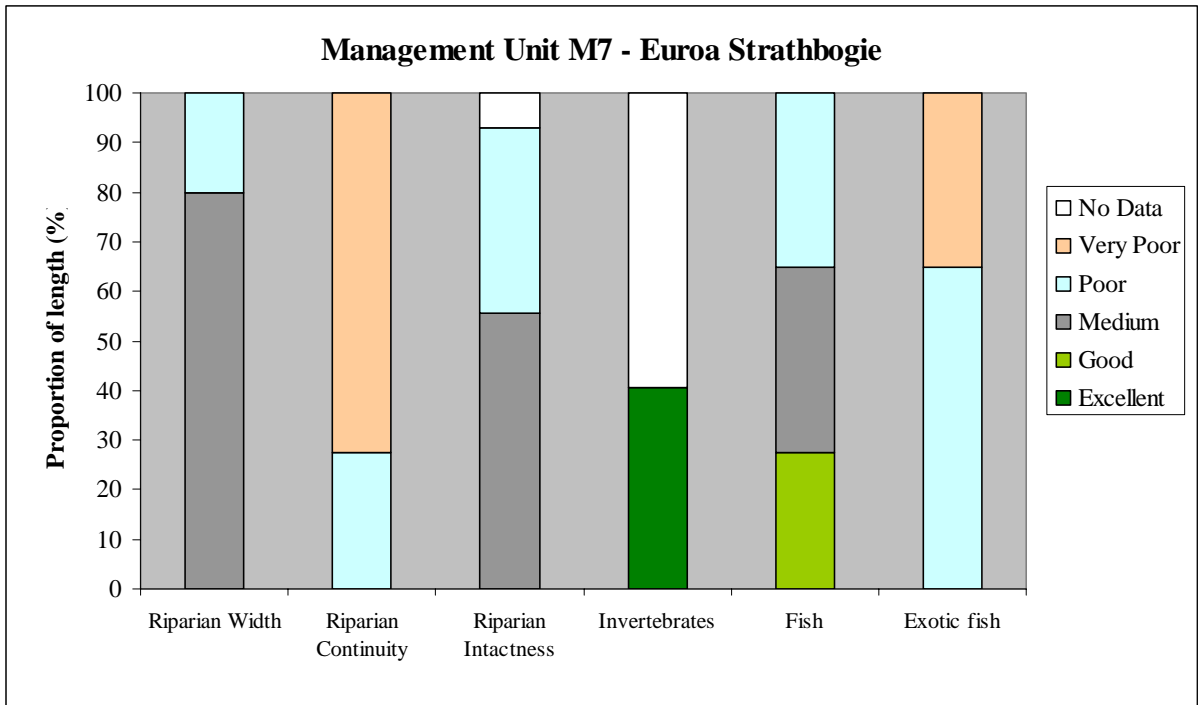


Figure 2.17. Proportion of stream length in Management Unit M7 with various Environmental Naturalness rating.



Seven Creeks (Reach 19)

2.4.3 Social Values

Few social values in the Management Unit rate highly (Figure 2.18), except the number of species of local significance known to inhabit most of the Management Unit (Table 2.17), and passive recreation, which is common (over 80% of the Management Unit length). Some significant fishing and swimming spots are found, all in Seven Creeks.

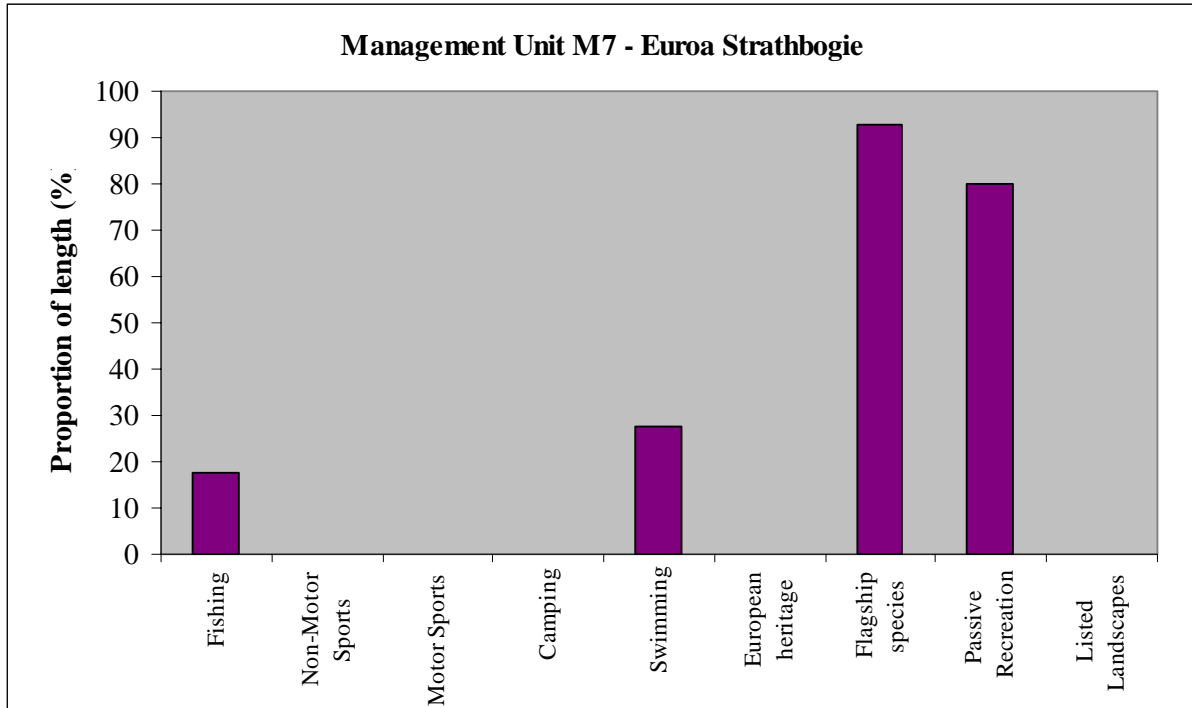


Figure 2.18. Proportion of stream length in Management Unit M7 with Very High or High Social value rating.

Table 2.17. Species of local significance found in Management Unit M7.

Brown trout	Platypus
Golden perch	River blackfish
Macquarie perch	Trout cod

2.4.4 Economic values

Economic values are particularly high for infrastructure (Figure 2.19) in the Management Unit, with water supply delivery (55% of the length) and land value (42%) also important. Tourism is a focus in Seven Creeks around Euroa, and the upper Seven Creeks is an important water supply collection area.



Castle Creek (Reach 26)

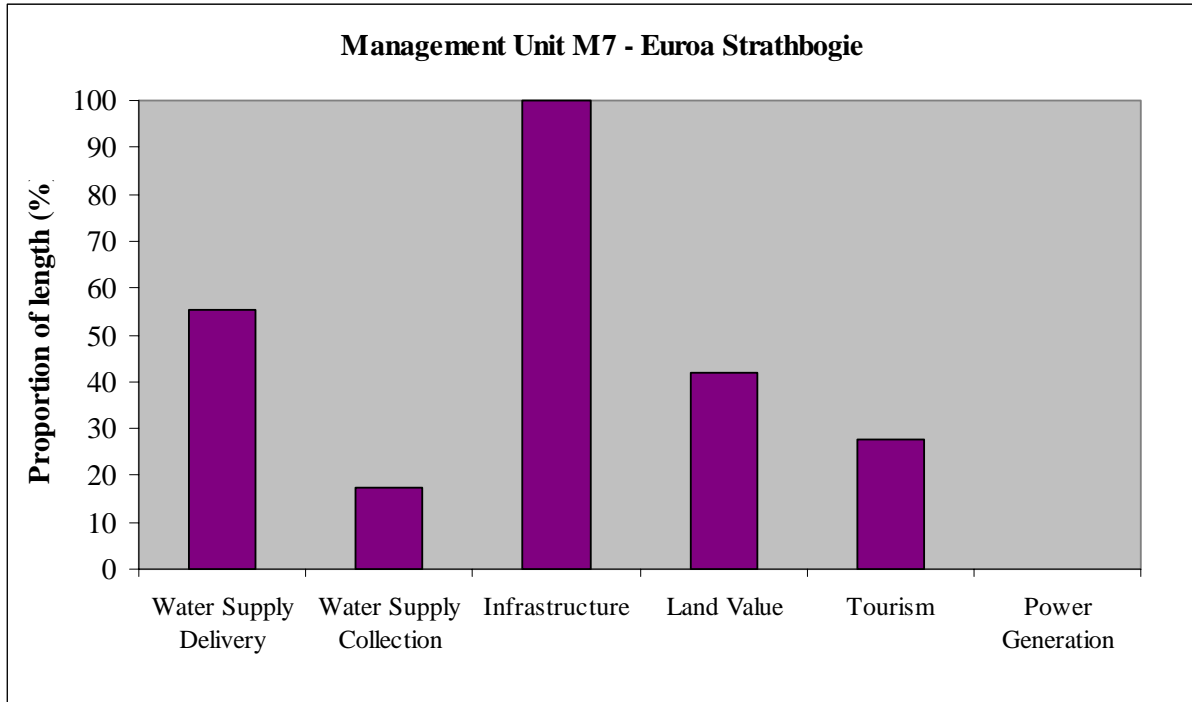


Figure 2.19. Proportion of stream length in Management Unit M7 with Very High or High Economic value rating.

2.4.5 Threats

Stock access is the main physical threat in the Management Unit (Figure 2.20), noted along the entire length. Other physical threats are uncommon. Flow deviation, temperature and conditions for algal blooms are not a threat, but there is limited data for water quality (although the two sites on Seven Creeks shows poor quality - Table 2.18). Riparian vegetation is degraded along 55% of the length of the Management Unit.

Table 2.18. Attainment of SEPP objectives for 6 water quality parameters in Management Unit M7 VWQMN sites. **✗** - not attained, **✓** - attained, blank – insufficient data.

VWQMN Site code	Location	Nitrogen	Phosphorous	DO	pH	Turbidity	EC
405234	Seven Creeks - Polly McQuinn Weir	✗	✗		✓	✗	✓
405237	Seven Creeks d/s of Euroa	✗	✗	✗	✓	✓	✓

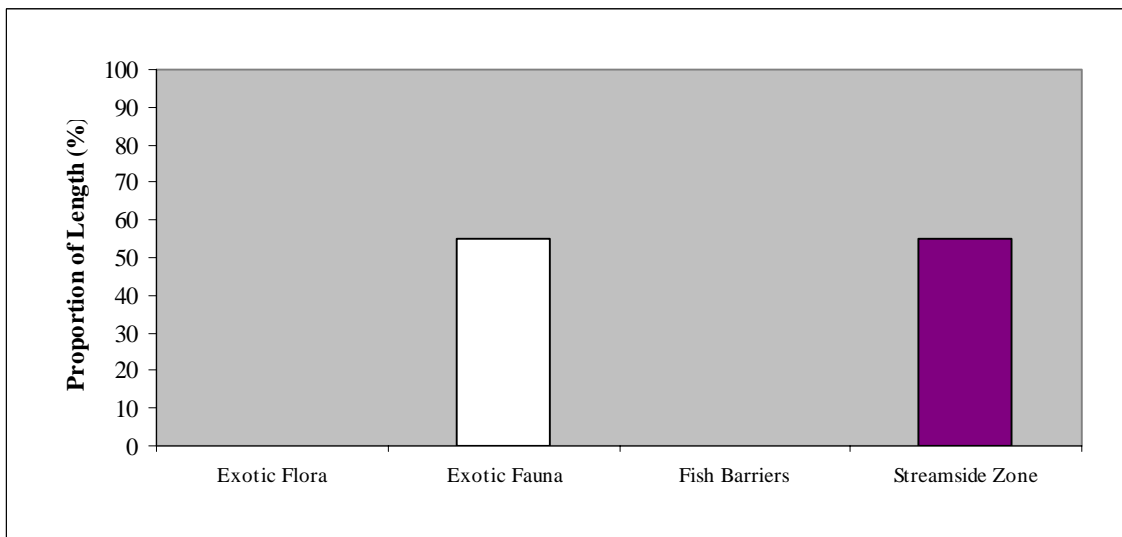
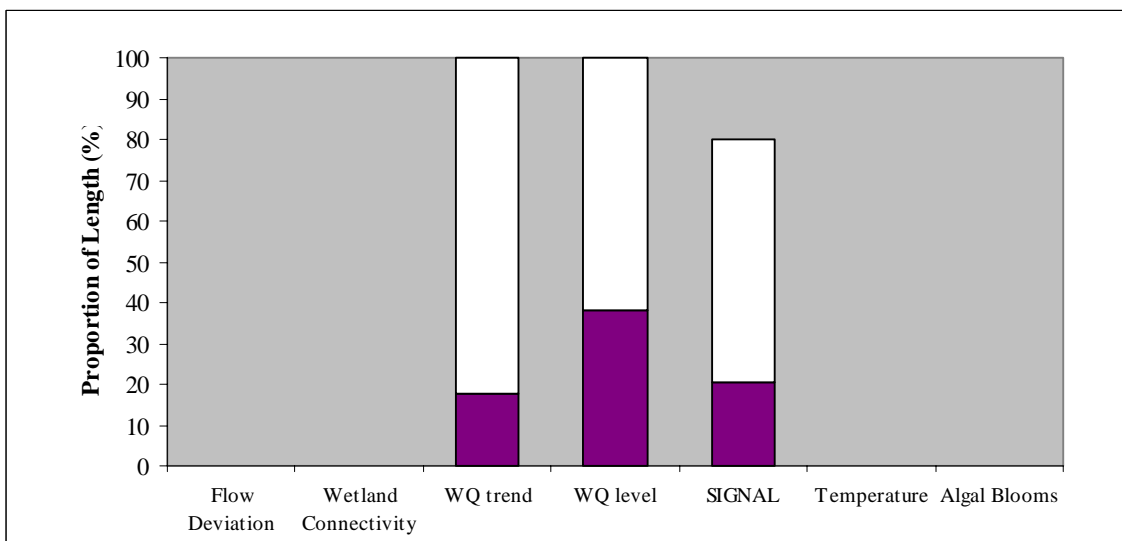
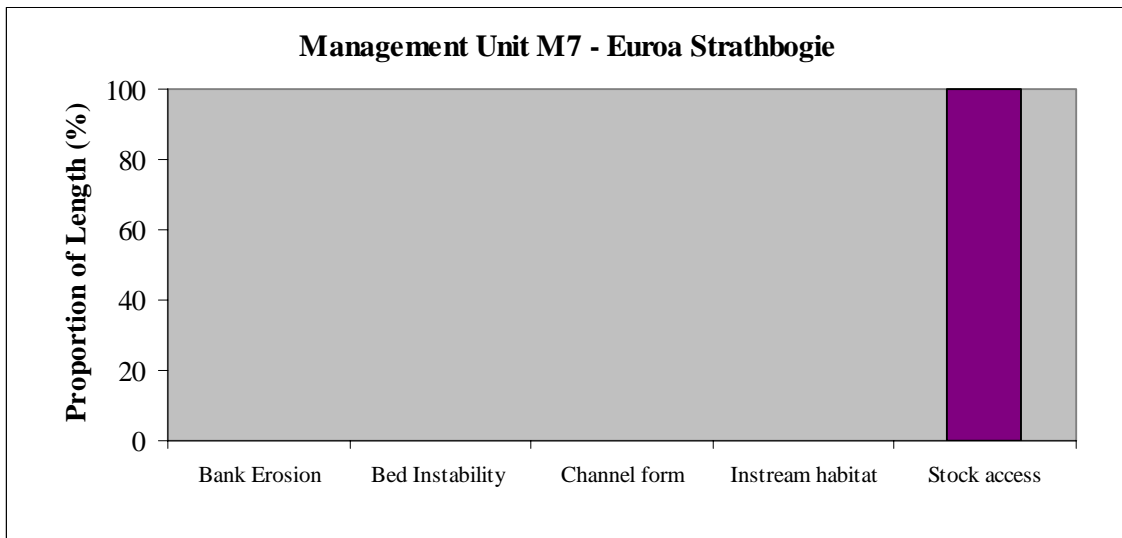


Figure 2.20. Proportion of stream length in Management Unit M7 with Very High or High Threat ratings for Physical (top), Flow and Chemical (middle) and Biological (bottom) components. Blank – No data.

2.5 Management Unit U1 – Mid Goulburn River

Management Unit U1 – Mid Goulburn River – covers the length of the Goulburn River between Eildon Reservoir and Goulburn Weir, a total length of stream of 145 km. Six reaches have been delineated that form the Management Unit (including one urban reach not included in the ISC).

2.5.1 Summary of Management Unit Values and Threats

The summary table for Environmental, Social and Economic values, and threat ratings for Management Unit U1 (Table 2.19) shows an overall rating for the Management Unit, based on a proportional (by reach length) average of all indices for each component from the RiVERS database.

The Index of Stream Condition scores for each ISC sub-index (Hydrology, Physical Form, Streamside Zone, Water Quality and Aquatic Life) for each reach in the Management Unit is shown in Table 2.20. Where no value for a sub-index is given, there is insufficient data to evaluate that sub-index.

Table 2.19. Summary Table for Environmental, Social and Economic values, and for threat ratings for Management Unit U1.

Environmental	Social	Economic	Threat
Moderate	High	High	Moderate

Table 2.20. Index of Stream Condition Scores for reaches in Management Unit U1.

Reach	Stream Name	Hydrology	Physical Form	Streamside Zone	Water Quality	Aquatic Life
9	Goulburn River	0				
10	Goulburn River	0	9	7		
11	Goulburn River	0	5	2		
12	Goulburn River	0	8	6		
13	Goulburn River	0	8	5	9	
14	Goulburn River	0	8	4	9	8
	Average	0.0	7.6	4.8	9.0	8.0

2.5.2 Environmental values

Rarity

The mid Goulburn River Management Unit (U1) has a Very High or High rarity rating over the entire length for a number of different values (Figure 2.21). The Management Unit is a declared Heritage River (LCC, 1991), and significant faunal species, significant Ecological Vegetation Classes and rare wetlands are found over the entire length (Table 2.21).

There are no representative rivers listed in the Management Unit.

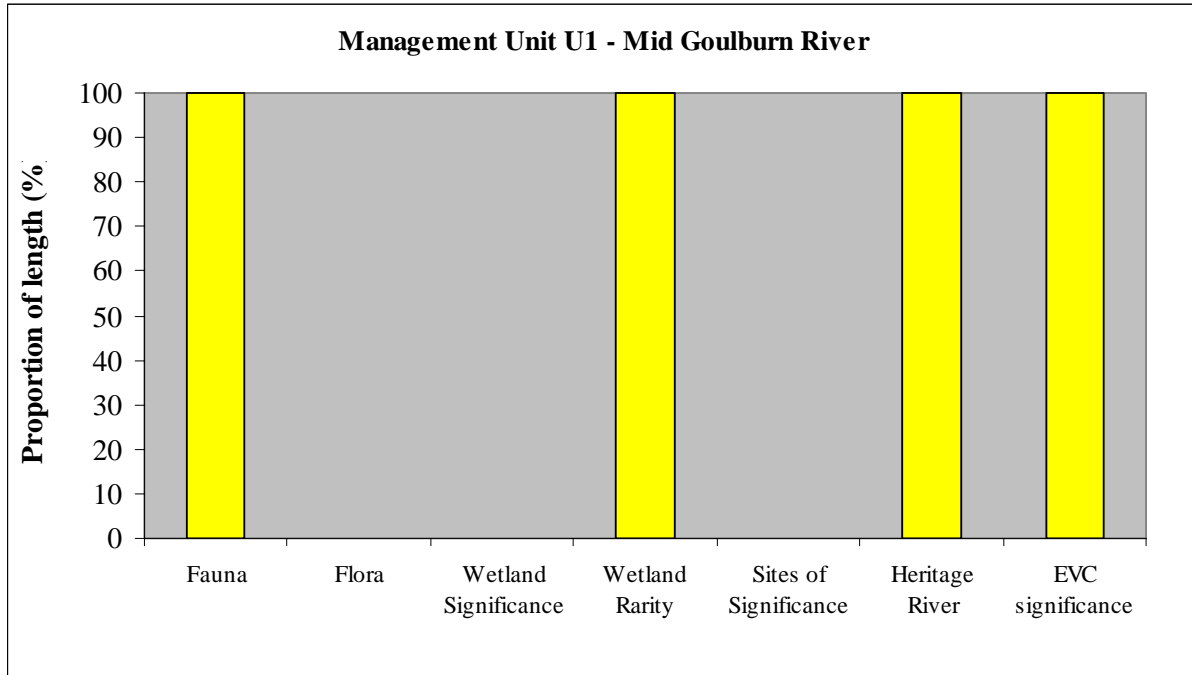


Figure 2.21. Proportion of stream length in Management Unit U1 with Very High or High Environmental Rarity rating.

Table 2.21. Significant fauna, flora and EVC in Management Unit U1.

Fauna	
<ul style="list-style-type: none"> • Australasian shoveler • Blue-billed duck • Brown quail • Brush-tailed phascogale • Diamond firetail • Golden perch • Great egret 	<ul style="list-style-type: none"> • Hardhead • Musk duck • Nankeen night heron • Pied cormorant • Powerful owl • Royal spoonbill
Flora	
EVC	
<ul style="list-style-type: none"> • Box Ironbark Forest • Creekline Grassy Woodland • Floodplain Riparian Woodland • Floodplain Riparian Woodland/Floodplain Wetland Mosaic • Floodplain Riparian Woodland/Plains Grassy Woodland Mosaic 	<ul style="list-style-type: none"> • Grassy Dry Forest • Grassy Woodland • Herb-rich Foothill Forest • Lagoon Wetland • Plains Grassy Woodland • Valley Grassy Forest

Naturalness

Most naturalness values are relatively low over the Management Unit (Figure 2.22). Riparian continuity is good or excellent only in half of the reaches, but width and structure are good in only one of these. Little macroinvertebrate data is available, and these show only moderate compliance with SEPP requirements. Native fish species are under-represented (compared to those expected), and introduced species are common everywhere.

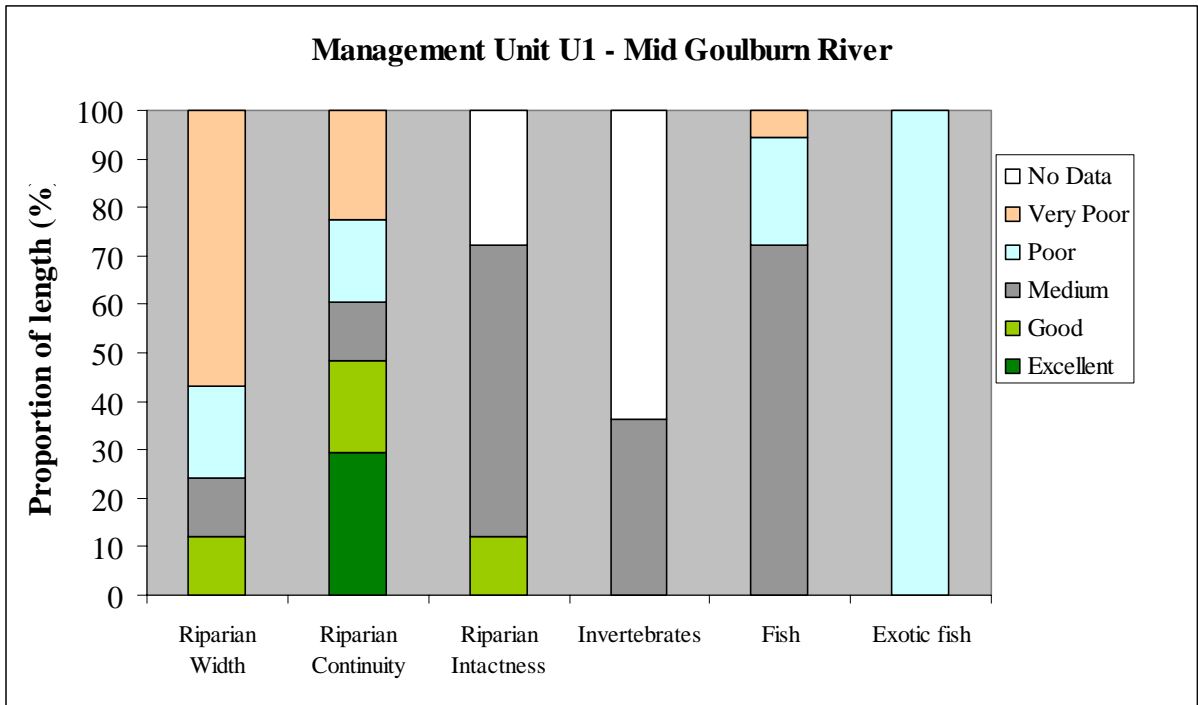


Figure 2.22. Proportion of stream length in Management Unit U1 with various Environmental Naturalness rating.



Goulburn River (Reach 11)

2.5.3 Social Values

Many Very High or High social values are found in the Management Unit (Figure 2.23), mainly concentrated around fishing, species of local significance species (Table 2.22) and passive recreation, but most values (except for swimming) are highly valued in at least parts of the Management Unit.

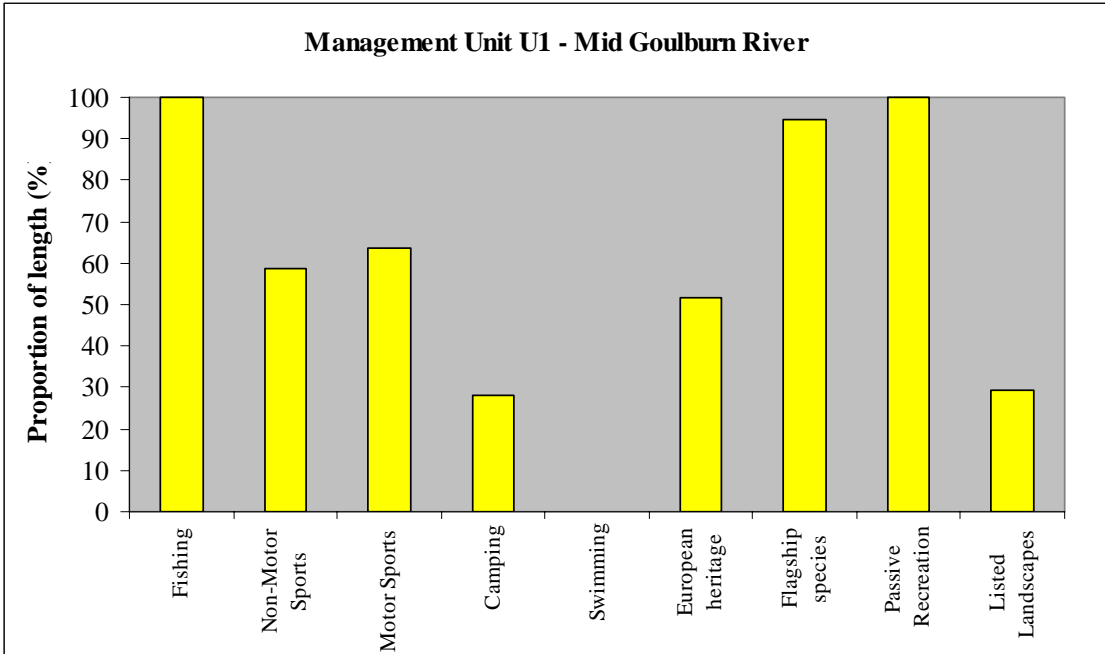


Figure 2.23. Proportion of stream length in Management Unit U1 with Very High or High Social value rating.

Table 2.22. Species of local significance found in Management Unit U1.

Brown trout	River redgum
Freshwater catfish	Spiny freshwater crayfish
Koala	Strawnecked ibis
Murray cod	Sugar glider
Platypus	Water rat
Rainbow trout	

2.5.4 Economic values

The entire length of the Management Unit is important for water supply delivery, infrastructure and land value (Figure 2.24). Tourism is another important economic value in the reach (over 71% of the length).

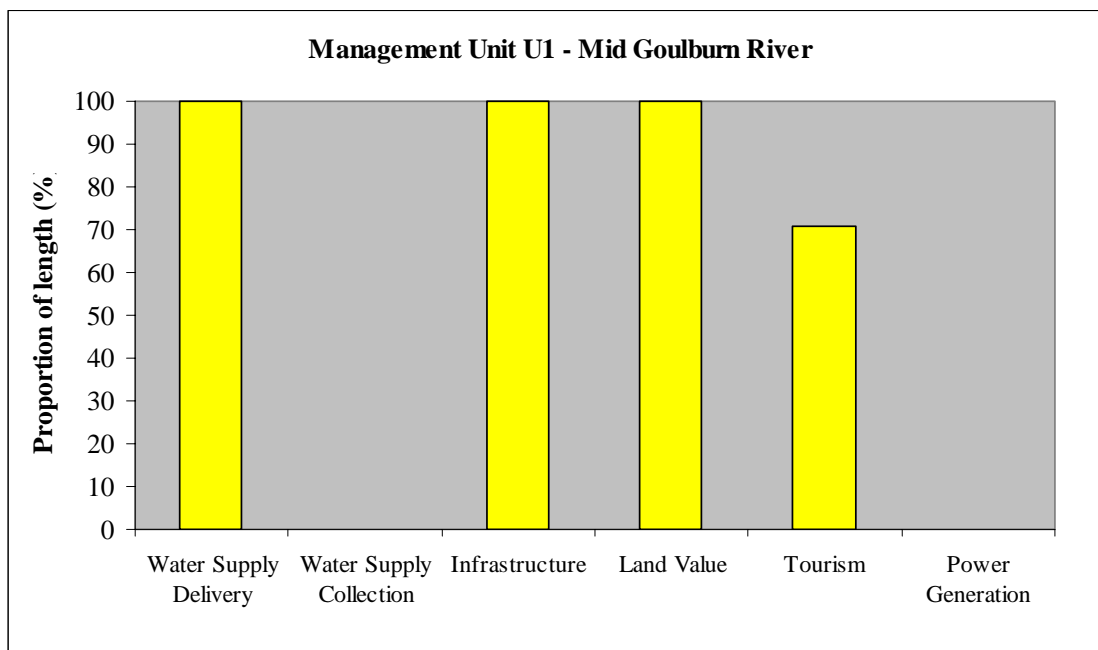


Figure 2.24. Proportion of stream length in Management Unit U1 with Very High or High Economic value rating.

2.5.5 Threats

Stock access is the main physical threat in the Management Unit (Figure 2.25), noted along 83% of the entire length. Other physical threats are relatively uncommon and are concentrated in the lower reach of the Management Unit. Flow deviation is high throughout due to Eildon Reservoir upstream, which also affects the water temperature through the reach. Little other water quality data is available (Table 2.23). Algal blooms have been recorded downstream of Eildon Reservoir. Fish passage is excluded from the entire reach by Goulburn Weir downstream and exotic flora is common over 59% of the Management Unit. No data on exotic fauna is available.

Table 2.23. Attainment of SEPP objectives for 6 water quality parameters in Management Unit U1 VWQMN sites. ✘ - not attained, ✓ - attained, blank – insufficient data.

VWQMN Site code	Location	Nitrogen	Phosphorous	DO	pH	Turbidity	EC
405203	Goulburn River at Eildon	✓	✓		✓	✓	✓

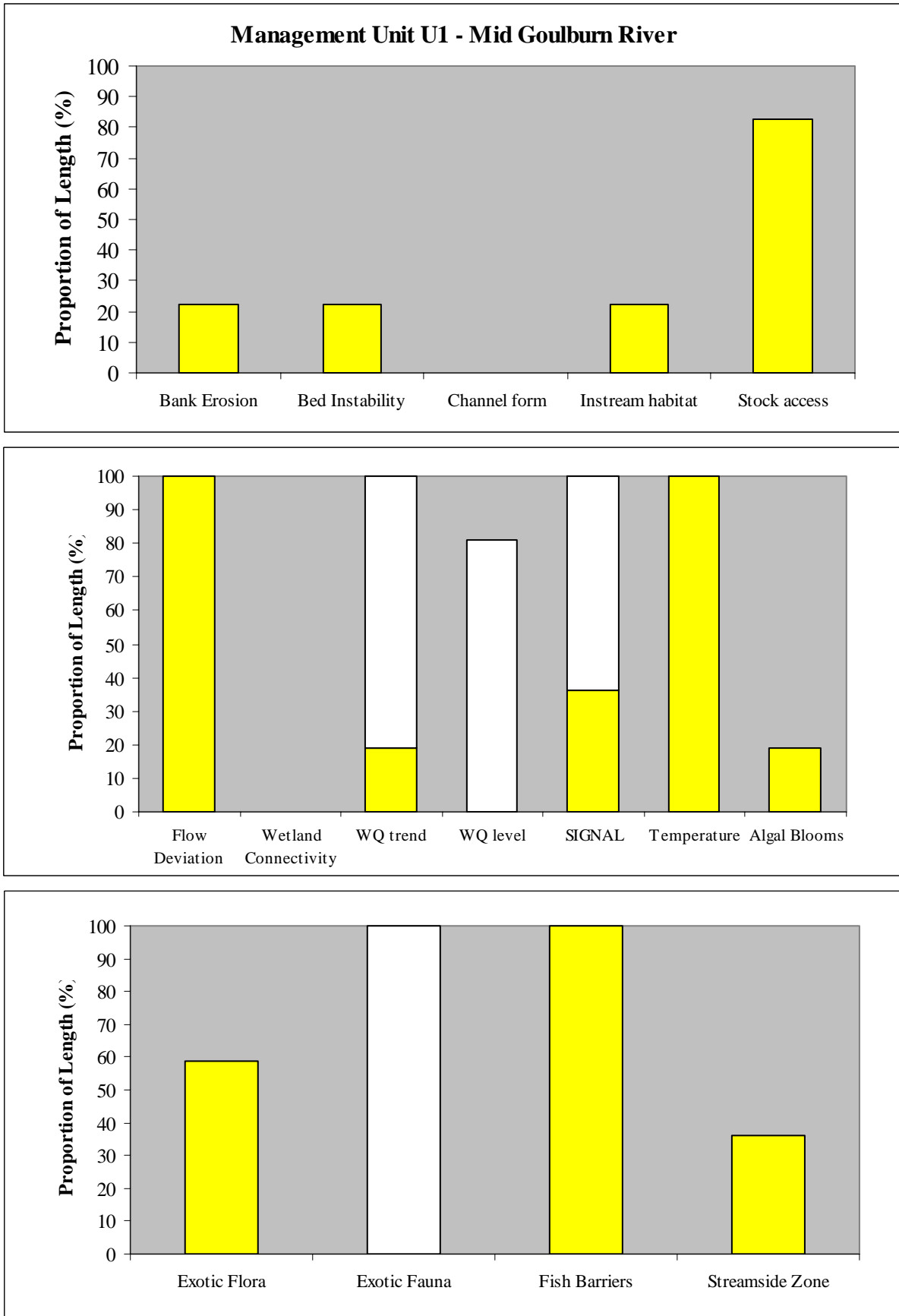


Figure 2.25. Proportion of stream length in Management Unit U1 with Very High or High Threat ratings for Physical (top), Flow and Chemical (middle) and Biological (bottom) components. Blank – No data.

2.6 Management Unit U2 – Majors/Hughes Creek

Management Unit U2 – Majors/Hughes Creek – covers the eastern and western tributaries that flow into the Goulburn River immediately upstream of Goulburn Weir, a total length of stream of 133 km. Six reaches have been delineated that form the Management Unit.

2.6.1 Summary of Management Unit Values and Threats

The summary table for Environmental, Social and Economic values, and threat ratings for Management Unit U2 (Table 2.24) shows an overall rating for the Management Unit, based on a proportional (by reach length) average of all indices for each component from the RiVERS database.

The Index of Stream Condition scores for each ISC sub-index (Hydrology, Physical Form, Streamside Zone, Water Quality and Aquatic Life) for each reach in the Management Unit is shown in Table 2.25. Where no value for a sub-index is given, there is insufficient data to evaluate that sub-index.

Table 2.24. Summary Table for Environmental, Social and Economic values, and for threat ratings for Management Unit U2.

Environmental	Social	Economic	Threat
Low	Moderate	Moderate	Low

Table 2.25. Index of Stream Condition Scores for reaches in Management Unit U2.

Reach	Stream Name	Hydrology	Physical Form	Streamside Zone	Water Quality	Aquatic Life
35	Bylands Creek	10	7	7		8
36	Hughes Creek	10	8	8		8
37	Hughes Creek	10	7	5		
38	Hughes Creek	10	3	4		9
39	Majors Creek	10	4	6		9
40	Whiteheads Creek	10	4	4		8
	Average	10.0	5.5	5.7	n.a.	8.4



Hughes Creek (Reach 37)

2.6.2 Environmental values

Rarity

The Majors/Hughes Creek Management Unit (U2) has a high or very high rarity rating over much of its length for significant Ecological Vegetation Classes (86% of the length) and significant faunal species (79% - Figure 2.31, Table 2.26), while 45% of the length rates highly for wetland rarity.

There are no representative rivers listed in the Management Unit.

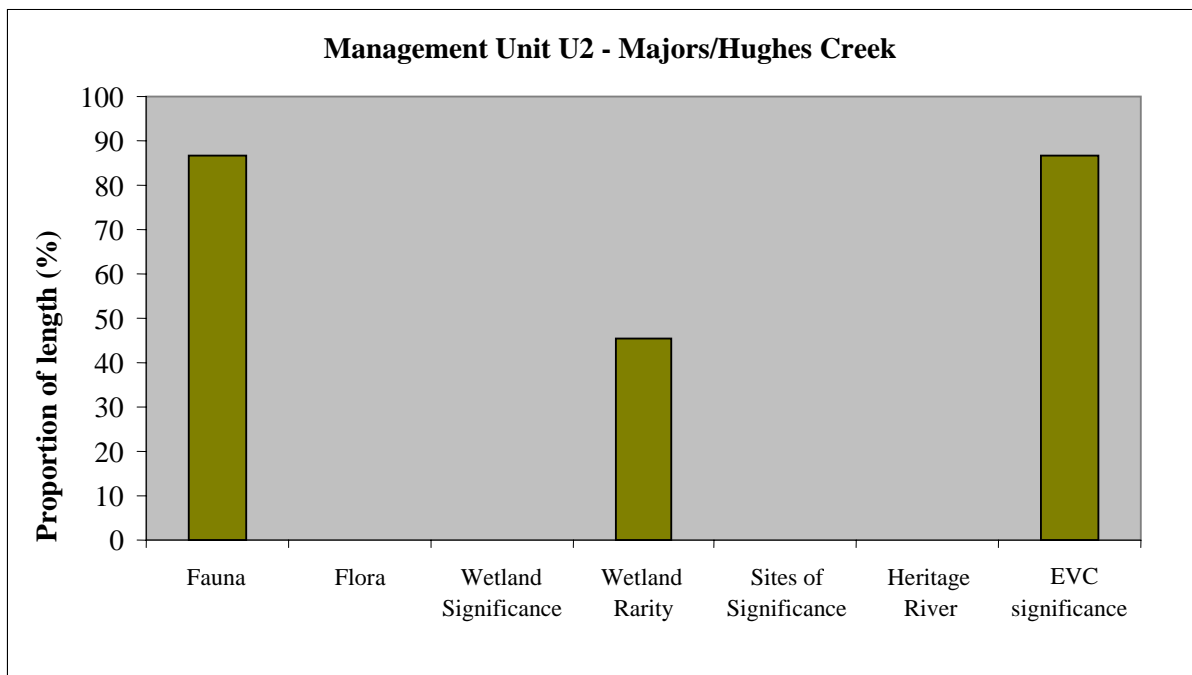


Figure 2.26. Proportion of stream length in Management Unit U2 with Very High or High Environmental Rarity rating.



Majors Creek (Reach 39)

Table 2.26. Significant fauna, flora and EVC in Management Unit U2.

Fauna	
<ul style="list-style-type: none"> • Freshwater catfish • Golden perch • Mountain galaxias 	<ul style="list-style-type: none"> • Squirrel glider • Macquarie perch • Bluenose(Trout) cod
Flora	
<ul style="list-style-type: none"> • Golden dodder 	
EVC	
<ul style="list-style-type: none"> • Alluvial Terraces Herb-rich Woodland • Alluvial Terraces Herb-rich Woodland/Creekline Grassy Woodland Mosaic • Box Ironbark Forest • Creekline Grassy Woodland • Floodplain Riparian Woodland • Gilgai Plain Woodland/Wetland Mosaic • Grassy Dry Forest • Grassy Woodland • Heathy Dry Forest • Herb-rich Foothill Forest 	<ul style="list-style-type: none"> • Low Rises Grassy Woodland/Alluvial Terraces Herb-rich Woodland Mosaic • Perched Boggy Shrubland Complex • Plains Grassy Woodland • Riparian Forest • Riparian Shrubland • Riverine Escarpment Scrub • Riverine Grassy Woodland/Riverine Sedgy Forest/Wetland Mosaic • Sand Ridge Woodland • Swampy Riparian Woodland • Valley Grassy Forest • Wetland Formation

Naturalness

While riparian continuity is Excellent over much of the Management Unit, Good or Excellent riparian width or structural intactness is more restricted (Figure 2.27). Other naturalness measures are low where there is data available (although macroinvertebrate communities meet SEPP guidelines in Whitehead Creek).

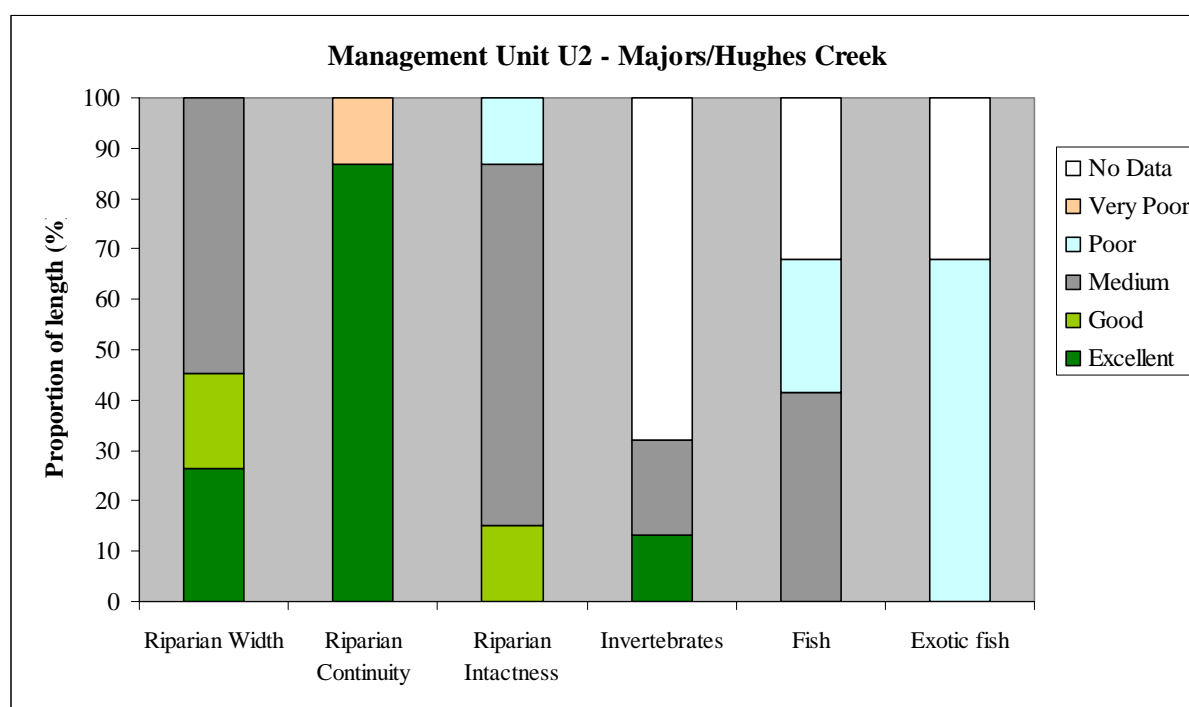


Figure 2.27. Proportion of stream length in Management Unit U1 with various Environmental Naturalness rating.

2.6.3 Social Values

Few high social values are found throughout the Management Unit (Figure 2.28). A number of species of local significance species inhabit the Management Unit (Table 2.27), and passive recreation is common (over 73% of the length of the Management Unit).

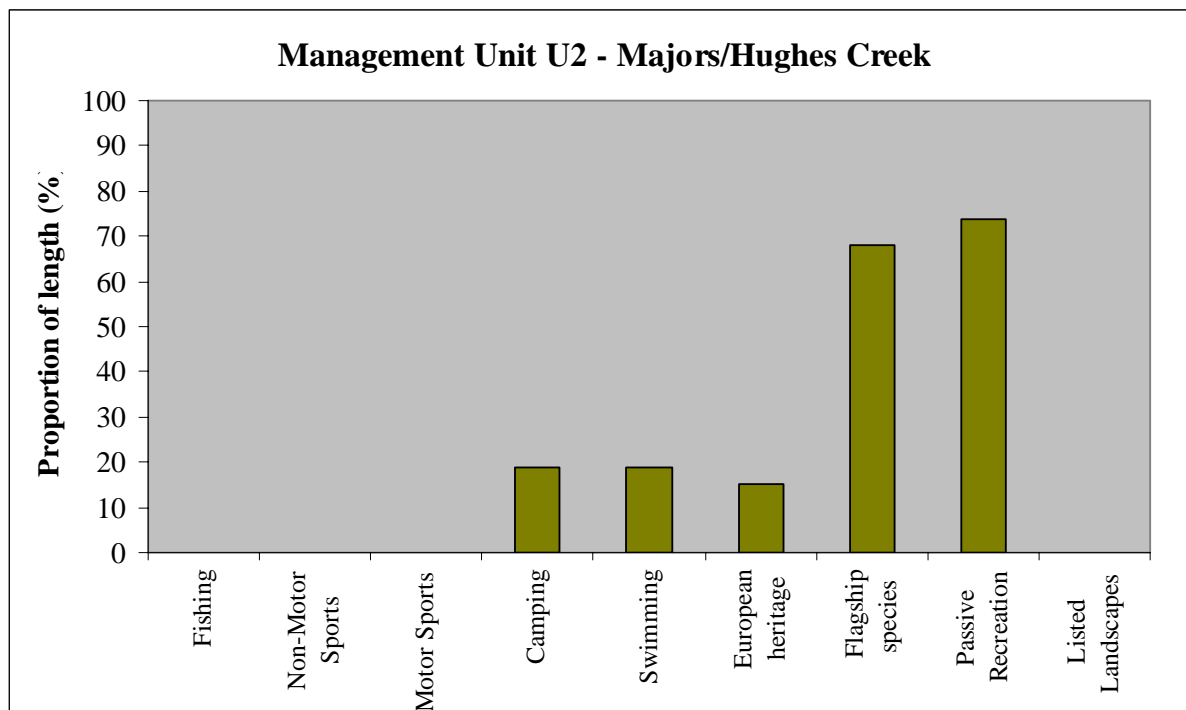


Figure 2.28. Proportion of stream length in Management Unit U2 with Very High or High Social value rating.

Table 2.27. Species of local significance found in Management Unit U2.

Brown trout	Platypus
Freshwater catfish	River blackfish
Macquarie perch	

2.6.4 Economic values

Major economic values in the Management Unit come from water supply delivery (68% of the length), infrastructure (74%) and land value (49% - Figure 2.29).

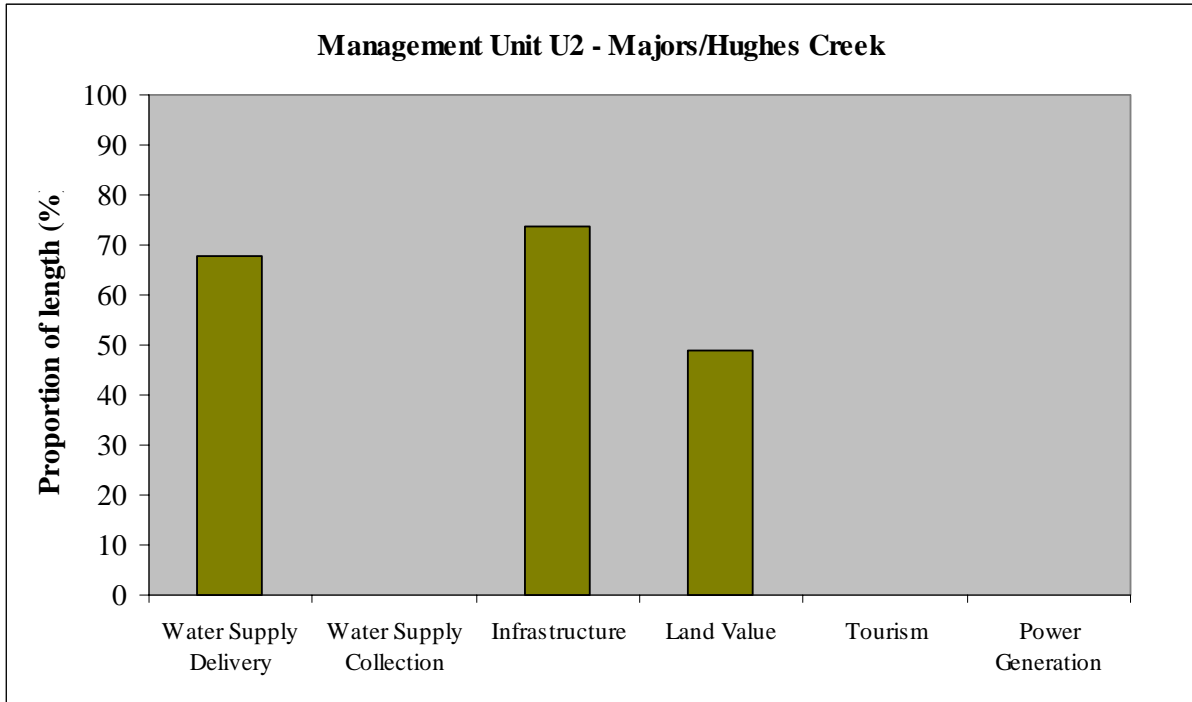
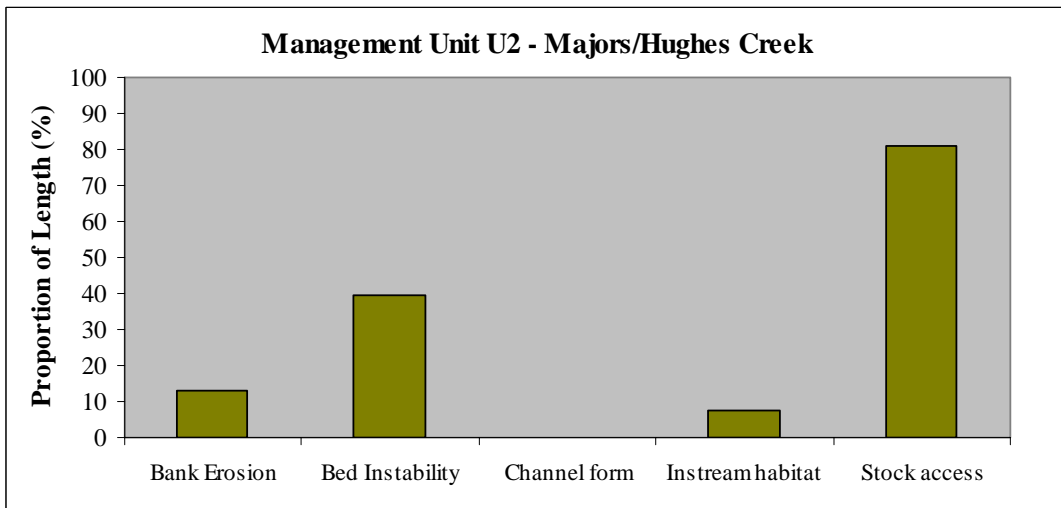


Figure 2.29. Proportion of stream length in Management Unit U2 with Very High or High Economic value rating.

2.6.5 Threats

Stock access is the main physical threat in the Management Unit (Figure 2.30), noted along 81% of the entire length. Of the other physical threats, bed instability is also relatively common (40% of the length). No significant flow deviations occur anywhere in the Management Unit, but water quality data are generally absent. Fish passage is excluded from the entire Management Unit by Goulburn Weir. No data on exotic fauna is available.



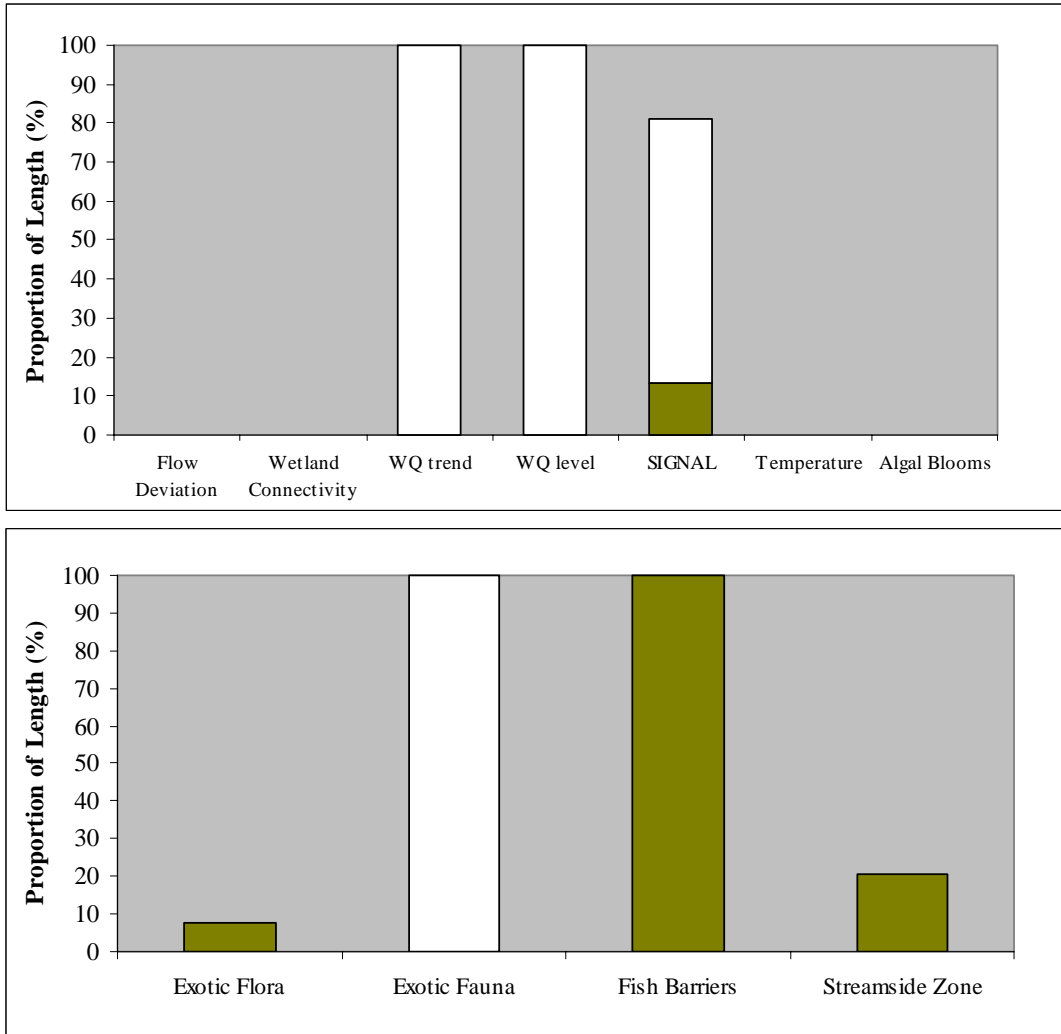


Figure 2.30. Proportion of stream length in Management Unit U2 with Very High or High Threat ratings for Physical (top), Flow and Chemical (middle) and Biological (bottom) components. Blank – No data.

2.7 Management Unit U3 – Sunday/Dry Creek

Management Unit U3 – Sunday/Dry Creek – covers a number of north-east flowing tributaries that flow into the Goulburn River upstream of Goulburn Weir, a total length of stream of 175 km. Twelve reaches have been delineated that form the Management Unit (including two urban reaches not included in the ISC).

2.7.1 Summary of Management Unit Values and Threats

The summary table for Environmental, Social and Economic values, and threat ratings for Management Unit U3 (Table 2.28) shows an overall rating for the Management Unit, based on a proportional (by reach length) average of all indices for each component from the RiVERS database.

The Index of Stream Condition scores for each ISC sub-index (Hydrology, Physical Form, Streamside Zone, Water Quality and Aquatic Life) for each reach in the Management Unit is shown in Table 2.29. Where no value for a sub-index is given, there is insufficient data to evaluate that sub-index.

Table 2.28. Summary Table for Environmental, Social and Economic values, and for threat ratings for Management Unit U3.

Environmental	Social	Economic	Threat
Low	Moderate	Moderate	Moderate

Table 2.29. Index of Stream Condition Scores for reaches in Management Unit U3.

Reach	Stream Name	Hydrology	Physical Form	Streamside Zone	Water Quality	Aquatic Life
41	Sugarloaf Creek	7	6	5	7	9
42	Molison Creek	10	7	5		9
43	Molison Creek	8	3	3		
44	Kurkurac Creek	9				8
45	Sunday Creek	7	6	5	5	9
46	Sunday Creek	6	7	6		9
47	Sunday Creek	10				
48	Dry Creek	10	9	7		
49	Dabyminga Creek	10	5	7		
50	Dabyminga Creek	10	5	7		
	Average	8.7	6.0	5.6	6.0	8.8

2.7.2 Environmental values

Rarity

The Sunday/Dry Creek Management Unit (U3) has a high or very high rarity rating over much of its length primarily for significant Ecological Vegetation Classes (87% of the length - Figure 2.31, Table 2.30). Other values are far less common in the Management Unit.

There are no representative rivers listed in the Management Unit.

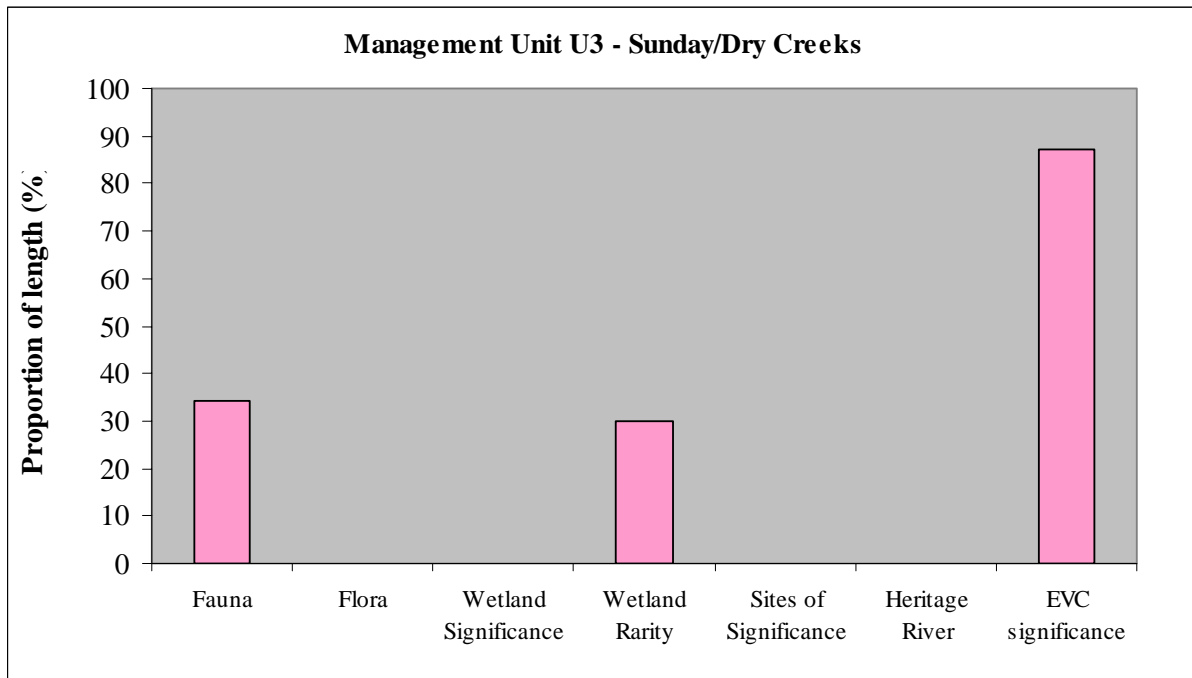


Figure 2.31. Proportion of stream length in Management Unit U3 with Very High or High Environmental Rarity rating.

Table 2.30. Significant fauna, flora and EVC in Management Unit U3.

Fauna	
<ul style="list-style-type: none"> • Great egret • Little egret • Pied cormorant 	<ul style="list-style-type: none"> • Powerful owl • Eastern horseshoe bat • Mountain galaxias
Flora	
EVC	
<ul style="list-style-type: none"> • Alluvial Terraces Herb-rich Woodland/Creekline Grassy Woodland Mosaic • Box Ironbark Forest • Creekline Grassy Woodland • Damp Forest • Floodplain Riparian Woodland • Grassy Dry Forest • Grassy Woodland • Herb-rich Foothill Forest 	<ul style="list-style-type: none"> • Plains Grassy Woodland • Plains Grassy Woodland/Creekline Grassy Woodland Mosaic • Riparian Forest • Riparian Forest/Creekline Grassy Woodland Mosaic • Slopes Box Grassy Woodland/Box Ironbark Forest Complex • Valley Grassy Forest • Valley Heathy Forest • Wet Forest

Naturalness

Riparian vegetation condition varies over this Management Unit, and are Excellent or Good only in Dry and Dabyminga Creeks (Figure 2.32). Native fish communities are missing expected species throughout, and exotic fish species are common. The macroinvertebrate data from 3 sites (Molison, Kurkurac and Sunday Creeks) all comply with SEPP requirements.

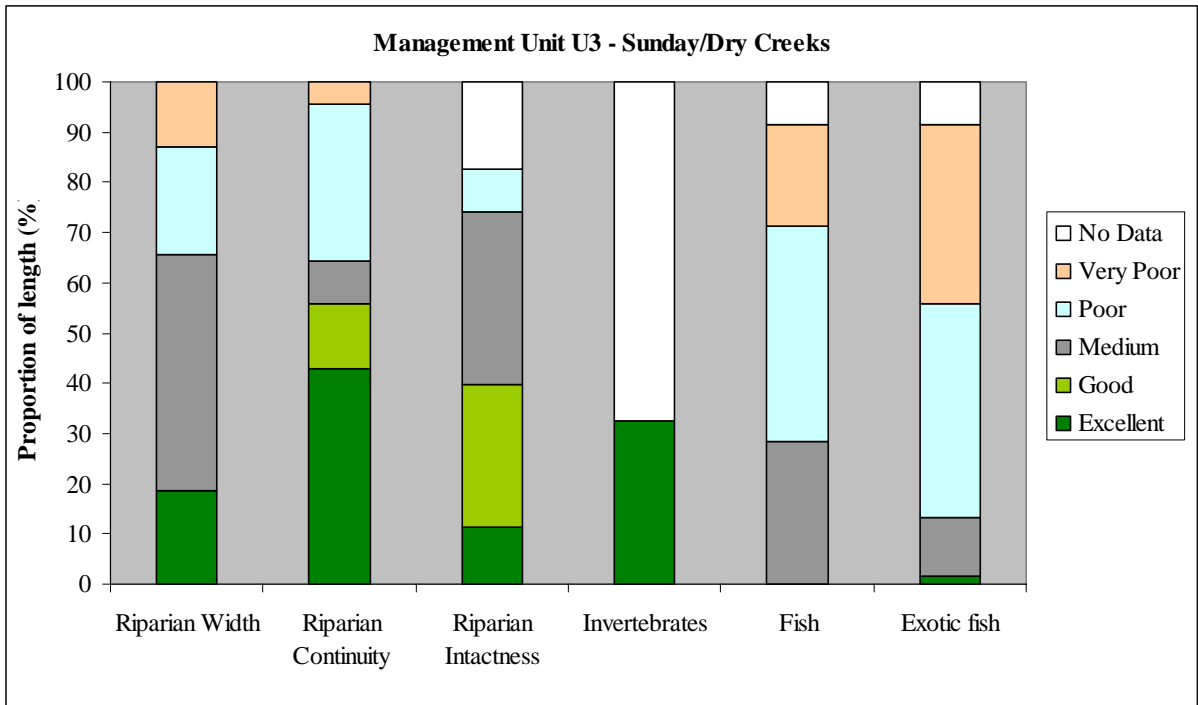


Figure 2.32. Proportion of stream length in Management Unit U1 with various Environmental Naturalness rating.

2.7.3 Social Values

Few social values in the Management Unit rate highly (Figure 2.33), except for species of local significance, found over 74% of the Management Unit (Table 2.31). European Heritage sites are scattered throughout the Management Unit.

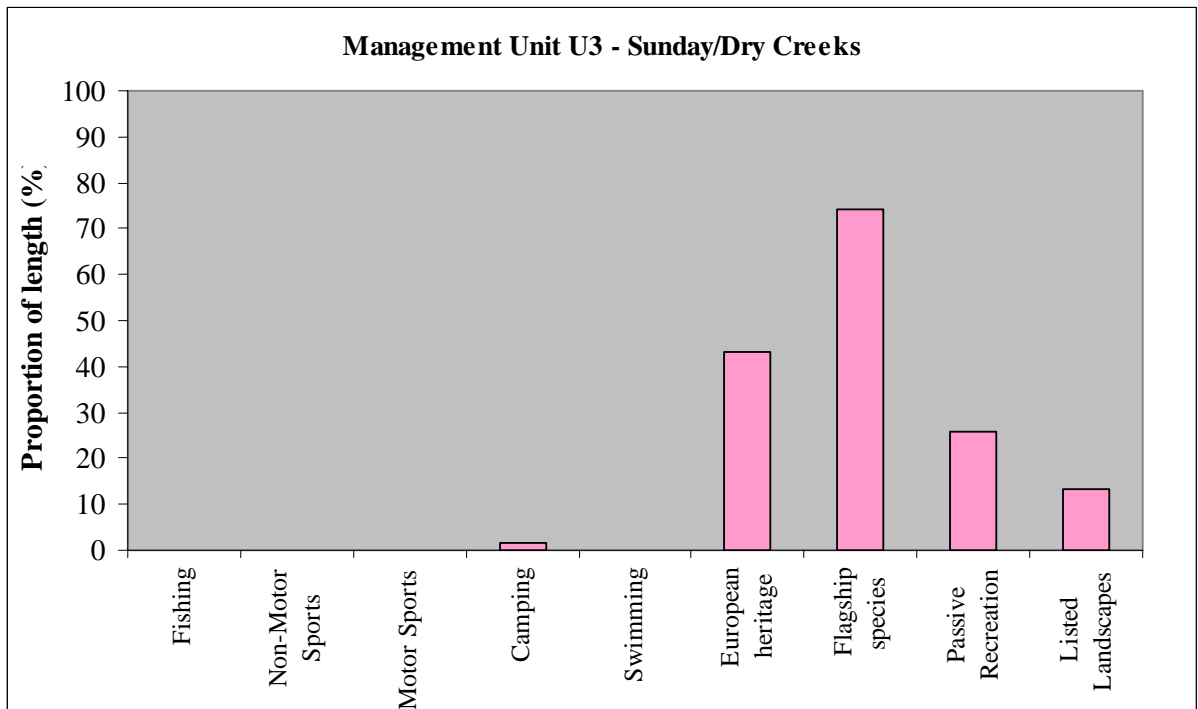


Figure 2.33. Proportion of stream length in Management Unit U3 with Very High or High Social value rating.

Table 2.31. Species of local significance found in Management Unit U3.

Brown trout	Rainbow trout
Lyre bird	River blackfish
Platypus	

2.7.4 Economic values

Economic values are particularly high primarily for infrastructure (Figure 2.34) throughout the Management Unit. Upper Molison and Sunday Creeks are rated highly for water supply assets.

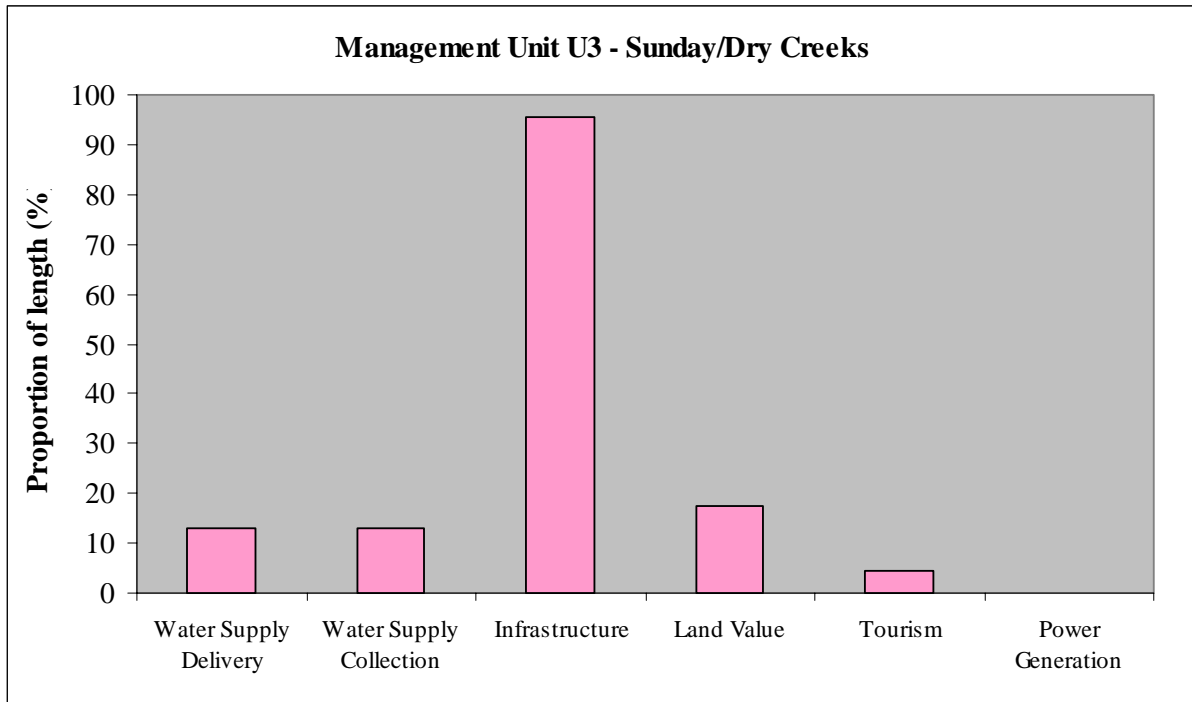


Figure 2.34. Proportion of stream length in Management Unit U3 with Very High or High Economic value rating.



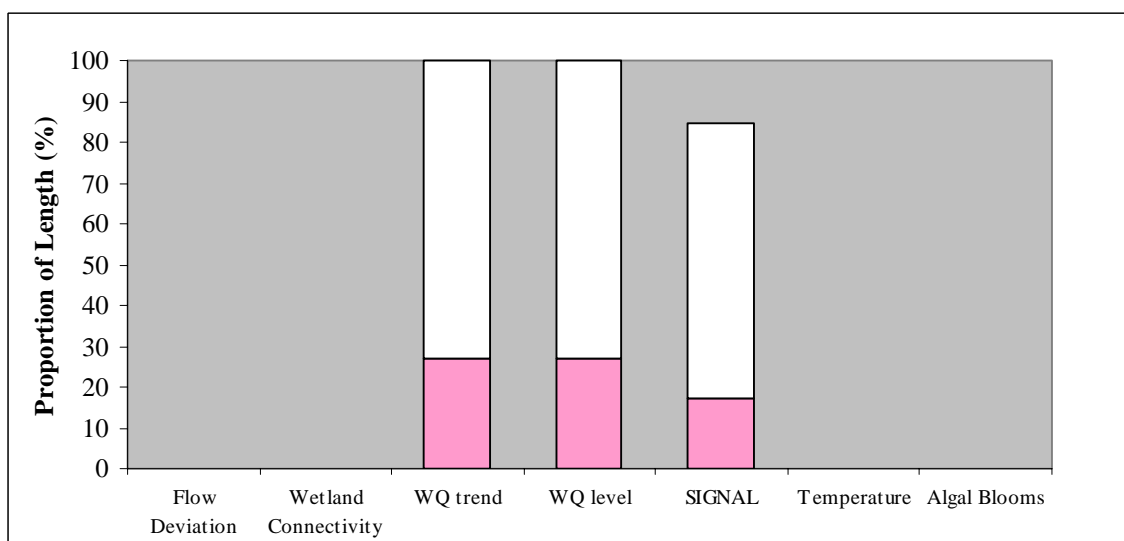
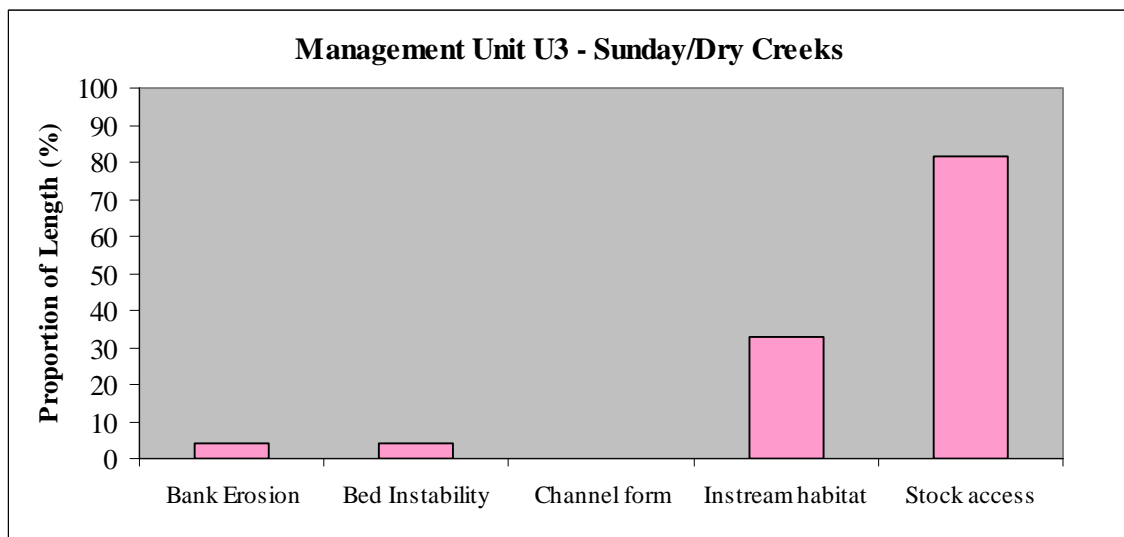
Sunday Creek (Reach 45)

2.7.5 Threats

Stock access is the main physical threat in the Management Unit (Figure 2.35), noted along 81% of the entire length. No significant flow deviations occur anywhere in the Management Unit. Water quality trends and levels, where data is available (Sugarloaf Creek and lower Sunday Creek - Table 2.32), are poor. Fish passage is excluded from the entire Management Unit by Goulburn Weir. No data on exotic fauna is available.

Table 2.32. Attainment of SEPP objectives for 6 water quality parameters in Management Unit U3 VWQMN sites. X - not attained, ✓ - attained, blank – insufficient data.

VWQMN Site code	Location	Nitrogen	Phosphorous	DO	pH	Turbidity	EC
405240	Sugarloaf Creek at Ash Bridge	X	X	X	✓	X	X
405212	Sunday Creek at Tallarook	X	X	X	✓	X	X



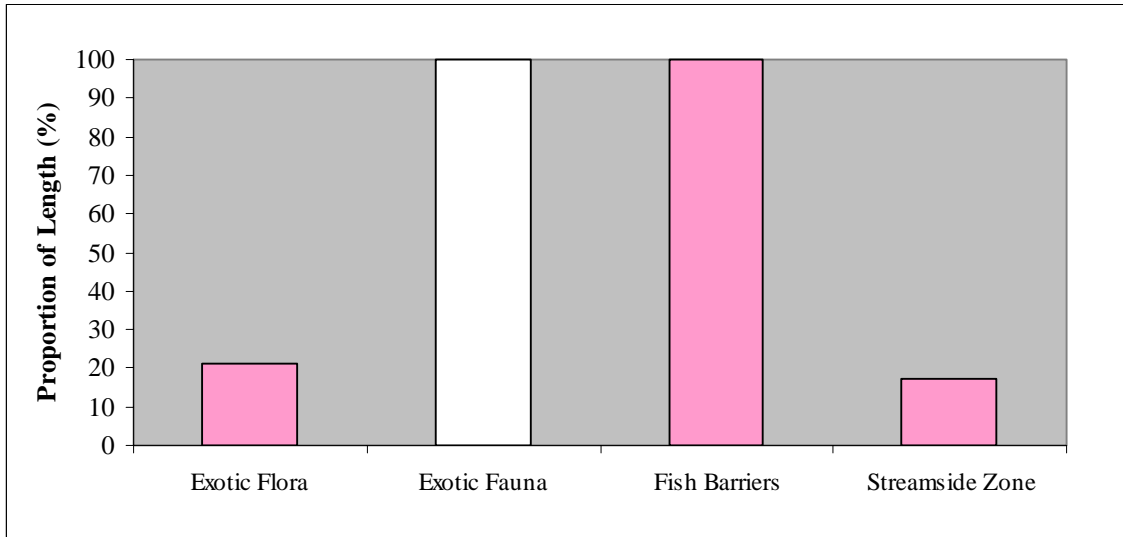


Figure 2.35. Proportion of stream length in Management Unit U3 with Very High or High Threat ratings for Physical (top), Flow and Chemical (middle) and Biological (bottom) components. Blank – No data.

2.8 Management Unit U4 – King Parrot Creek/Yea River

Management Unit U4 – King Parrot Creek/Yea River – covers a number of north flowing tributaries that flow into the Goulburn River in the mid-reaches between Eildon Reservoir and Goulburn Weir, a total length of stream of 168 km. Ten reaches have been delineated that form the Management Unit (including one urban reach not included in the ISC).

2.8.1 Summary of Management Unit Values and Threats

The summary table for Environmental, Social and Economic values, and threat ratings for Management Unit U4 (Table 2.33) shows an overall rating for the Management Unit, based on a proportional (by reach length) average of all indices for each component from the RiVERS database.

The Index of Stream Condition scores for each ISC sub-index (Hydrology, Physical Form, Streamside Zone, Water Quality and Aquatic Life) for each reach in the Management Unit is shown in Table 2.34. Where no value for a sub-index is given, there is insufficient data to evaluate that sub-index.

Table 2.33. Summary Table for Environmental, Social and Economic values, and for threat ratings for Management Unit U4.

Environmental	Social	Economic	Threat
Low	Moderate	Moderate	Low

Table 2.34. Index of Stream Condition Scores for reaches in Management Unit U4.

Reach	Stream Name	Hydrology	Physical Form	Streamside Zone	Water Quality	Aquatic Life
51	King Parrot Creek	6	6	7		9
52	King Parrot Creek	5	6	7	9	10
53	Dairy Creek	10	4	4		
54	Yea River	10	7	4		9
55	Yea River	9	8	7		
56	Yea River	9	8	5		10
57	Yea River	8	6	8		10
58	Murrindindi River	10	6	4		10
59	Murrindindi River	10	9	9	9	
	Average	8.6	6.7	6.1	9.0	9.7



Yea River (Reach 55)

2.8.2 Environmental values

Rarity

The main high or very high environmental rarity ratings in the King Parrot/Yea River Management Unit (U4) are for significant faunal species (85% of the length) and significant Ecological Vegetation Classes (51% - Figure 2.36, Table 2.35).

The Yea River and the Murrindindi Rivers were suggested as possible representative rivers for the North Central uplands River Region in the VRHS (NRE, 2002). The Goulburn Broken Regional River Health Strategy suggested the Taggerty River in Management Unit U6 would be more suitable.

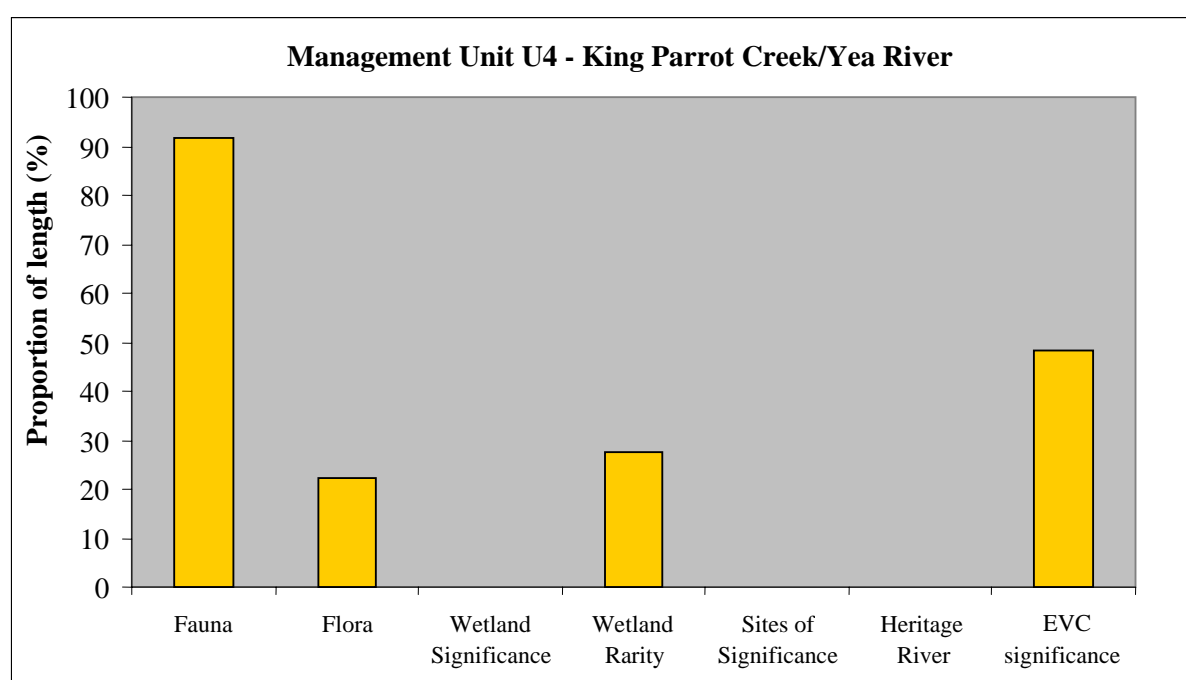


Figure 2.36. Proportion of stream length in Management Unit U4 with Very High or High Environmental Rarity rating.

Table 2.35. Significant fauna, flora and EVC in Management Unit U4.

Fauna	
• Australasian shoveler	• Macquarie perch
• Brown quail	• Mountain galaxias
• Brush-tailed phascogale	• Musk duck
• Bush stone-curlew	• Nankeen night heron
• Damselfly	• Pacific gull
• Diamond firetail	• Pied cormorant
• Great egret	• Powerful owl
• Grey goshawk	• Regent honeyeater
• Hardhead	• Royal spoonbill
• Helmeted honeyeater	• Sooty owl
• Hooded robin	• Speckled warbler
• Leadbeater's possum	• Spot-tailed quoll
• Lewin's rail	

Flora	
• Round-leaf pomaderris	
EVC	
• Cool Temperate Rainforest	• Plains Grassy Woodland
• Damp Forest	• Riparian Forest
• Floodplain Riparian Woodland	• Riparian Scrub
• Floodplain Riparian Woodland/Plains Grassy Woodland Mosaic	• Shrubby Foothill Forest
• Grassy Dry Forest	• Swampy Riparian Complex
• Grassy Woodland	• Swampy Riparian Woodland
• Heathy Dry Forest	• Valley Grassy Forest
• Herb-rich Foothill Forest	• Wet Forest
• Lowland Forest	

Naturalness

Riparian condition, the macroinvertebrate community and fish composition show Excellent to Good sporadically over the Management Unit (Figure 2.37). Only King Parrot Creek has high value for fish community (28% of the length of the Management Unit), and exotic fish species are common.

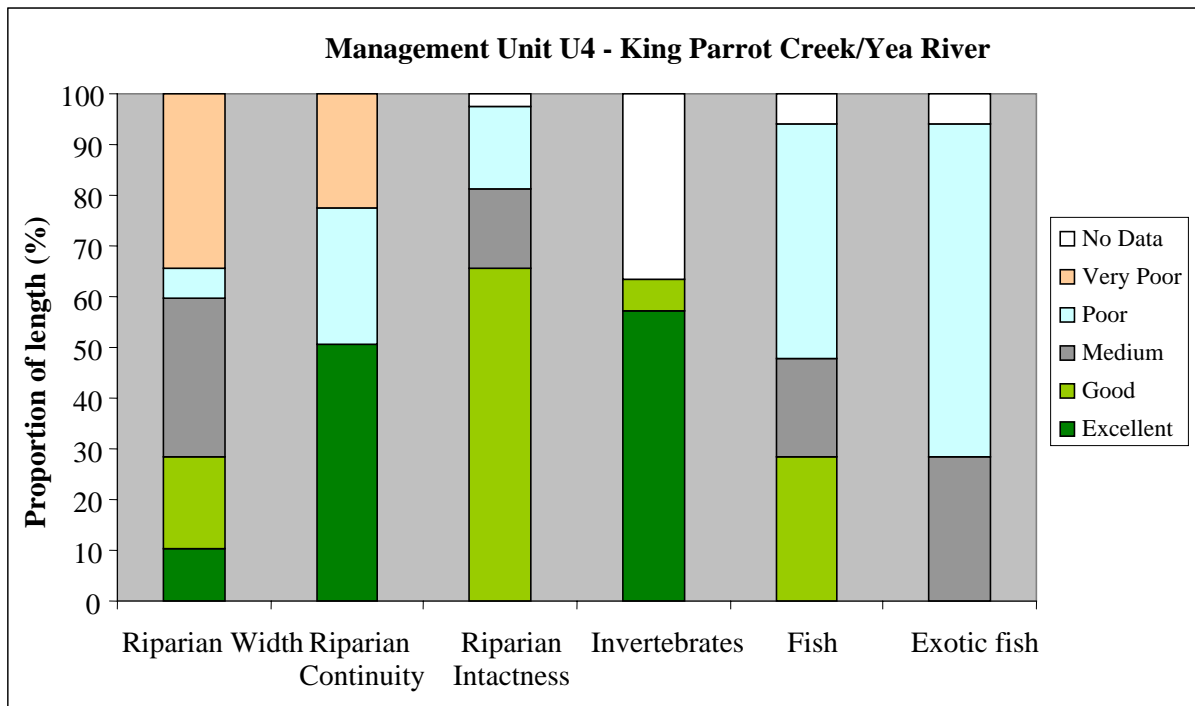


Figure 2.37. Proportion of stream length in Management Unit U4 with various Environmental Naturalness rating.

2.8.3 Social Values

Major highly rated social values in the King Parrot/Yea River Management Unit (Figure 2.38) are the presence of species of local significance (Table 2.36), passive recreation and listed landscapes.

Table 2.36. Species of local significance found in Management Unit U4.

Barred galaxias	Platypus
Brown trout	Rainbow trout
King parrot	River blackfish
Lyre bird	Spiny freshwater crayfish
Macquarie perch	

2.8.4 Economic values

Economic values in Management Unit U4 are high for a number of factors (Figure 2.39) with water supply delivery valuable over 94% of the length. Infrastructure (90%), land value (77%) and tourism (30%) are also important economic values.

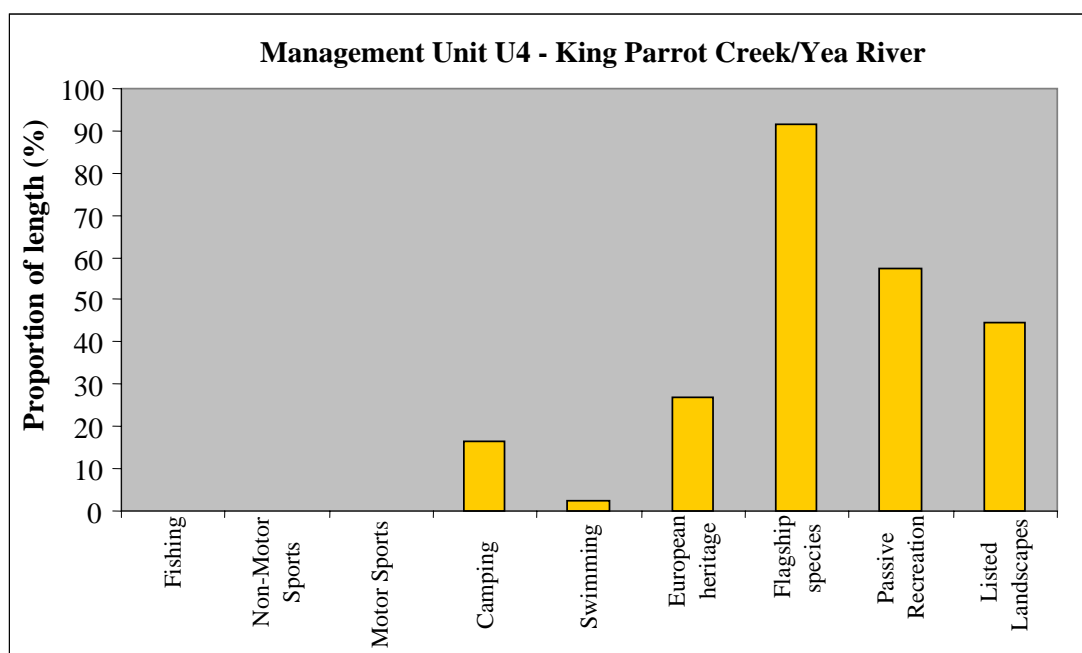


Figure 2.38. Proportion of stream length in Management Unit U4 with Very High or High Social value rating.

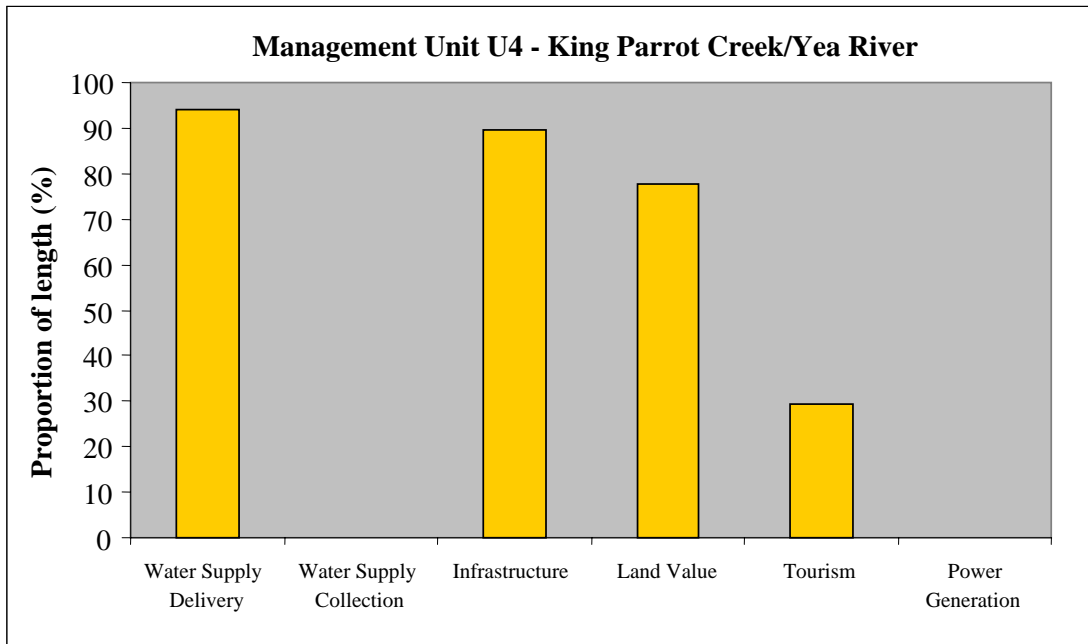


Figure 2.39. Proportion of stream length in Management Unit U4 with Very High or High Economic value rating.

2.8.5 Threats

Stock access is the main physical threat in the Management Unit (Figure 2.40), noted along 67% of the entire length (with no data recorded for the rest of the Management Unit). No significant flow deviations occur anywhere in the Management Unit. Water quality data is rare, with levels failing one nutrient SEPP objective in each of the King Parrot Creek and Murrindindi River (Table 2.37). Fish passage is excluded from the entire Management Unit by Goulburn Weir. No data on exotic fauna is available for this Management Unit.

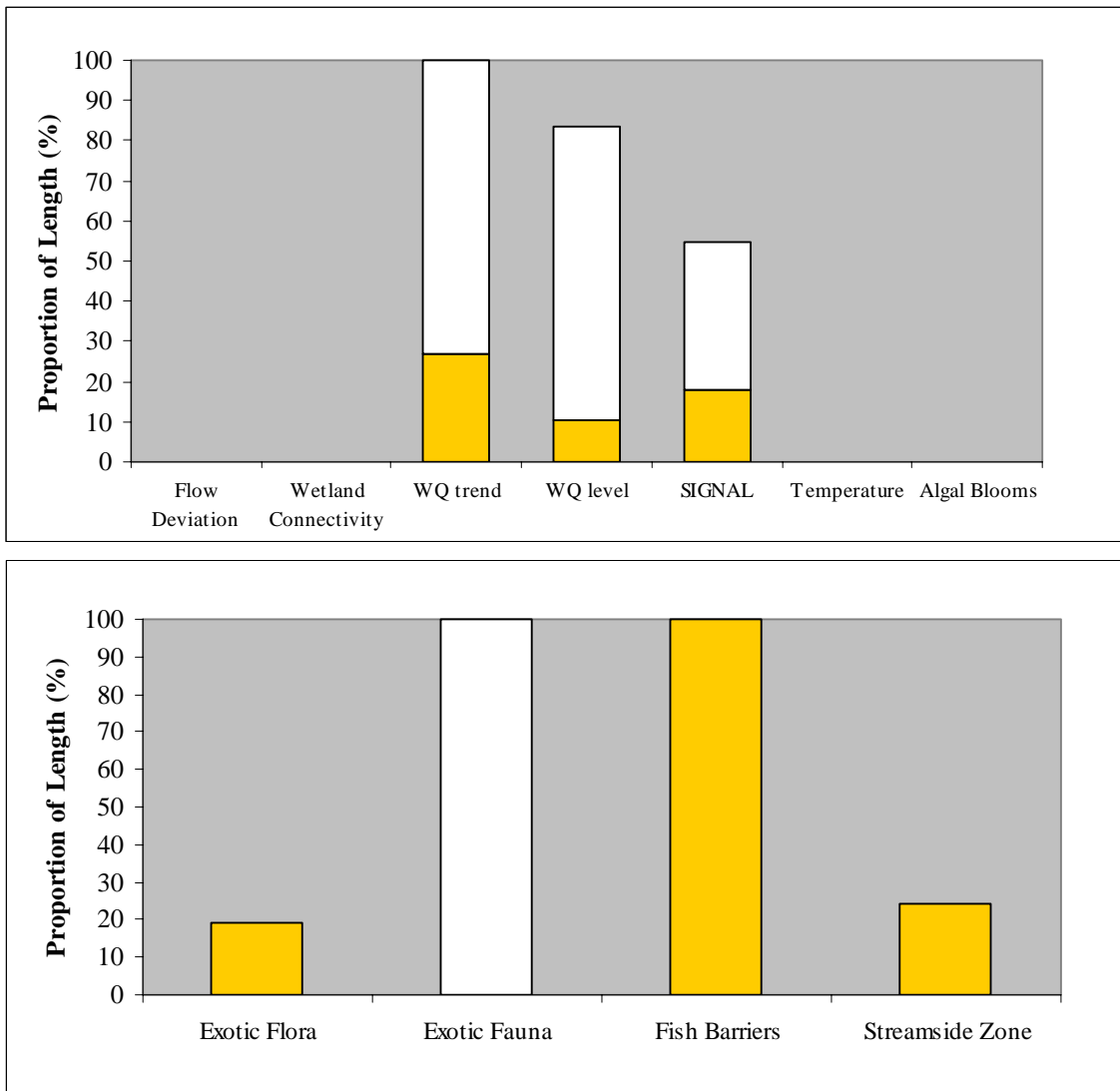


Figure 2.40. Proportion of stream length in Management Unit U4 with Very High or High Threat ratings for Physical (top), Flow and Chemical (middle) and Biological (bottom) components. Blank – No data.

Table 2.37. Attainment of SEPP objectives for 6 water quality parameters in Management Unit U4 VWQMN sites. X - not attained, ✓ - attained, blank – insufficient data.

VWQMN Site code	Location	Nitrogen	Phosphorous	DO	pH	Turbidity	EC
405205	Murrindindi River at Murrindindi	✓	X	✓	✓	✓	✓
405231	King Parrot Creek at Flowerdale	X	✓	✓	✓	✓	✓

2.9 Management Unit U5 – Northern tributaries

Management Unit U5 – Northern tributaries – covers a number of south flowing tributaries, two that flow into the Goulburn River downstream of Eildon Reservoir, and two that flow into the northern arms of Eildon Reservoir, a total length of stream of 110 km. Six reaches have been delineated that form the Management Unit (including one urban reach not included in the ISC).

2.9.1 Summary of Management Unit Values and Threats

The summary table for Environmental, Social and Economic values, and threat ratings for Management Unit U5 (Table 2.38) shows an overall rating for the Management Unit, based on a proportional (by reach length) average of all indices for each component from the RiVERS database.

The Index of Stream Condition scores for each ISC sub-index (Hydrology, Physical Form, Streamside Zone, Water Quality and Aquatic Life) for each reach in the Management Unit is shown in Table 2.39. Where no value for a sub-index is given, there is insufficient data to evaluate that sub-index.

Table 2.38. Summary Table for Environmental, Social and Economic values, and for threat ratings for Management Unit U5.

Environmental	Social	Economic	Threat
Low	Low	Moderate	Moderate

Table 2.39. Index of Stream Condition Scores for reaches in Management Unit U5.

Reach	Stream Name	Hydrology	Physical Form	Streamside Zone	Water Quality	Aquatic Life
60	Home Creek	9	6	5		9
61	Spring Creek	10	4	4		9
73	Ford Creek	9	3	3		8
74	Brankeet Creek	10	6	2	9	9
75	Merton Creek	10	3	2		
	Average	9.6	4.4	3.2	9.0	8.8

2.9.2 Environmental values

Rarity

The Northern Tributaries Management Unit (U5) has a high or very high rarity rating mainly for significant fauna (81%), Ecological Vegetation Classes (79% of the length), and wetland rarity (41% - Figure 2.41, Table 2.40).

There are no representative rivers listed in the Management Unit.

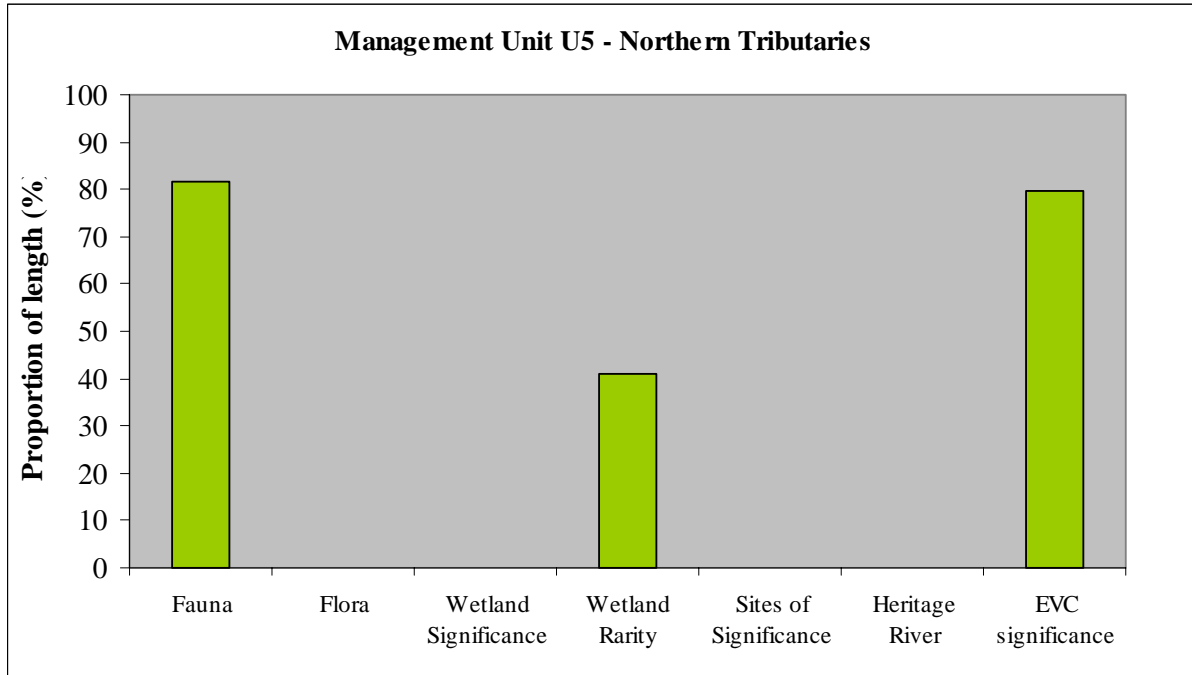


Figure 2.41. Proportion of stream length in Management Unit U5 with Very High or High Environmental Rarity rating.

Table 2.40. Significant fauna, flora and EVC in Management Unit U5.

Fauna	
• Flat-headed galaxias	
Flora	
EVC	
• Damp Forest	• Herb-rich Foothill Forest
• Floodplain Riparian Woodland	• Plains Grassy Woodland
• Grassy Dry Forest	• Valley Grassy Forest

Home Creek (Reach 50)



Naturalness

Few parts of the Northern Tributaries Management Unit have high naturalness values (Figure 2.42) with generally Moderate to Poor riparian vegetation measures. Aquatic macroinvertebrate communities are Excellent or Good over 55% of the Management Unit, but the native fish community is missing expected species throughout. Only Spring Creek has no exotic species present.

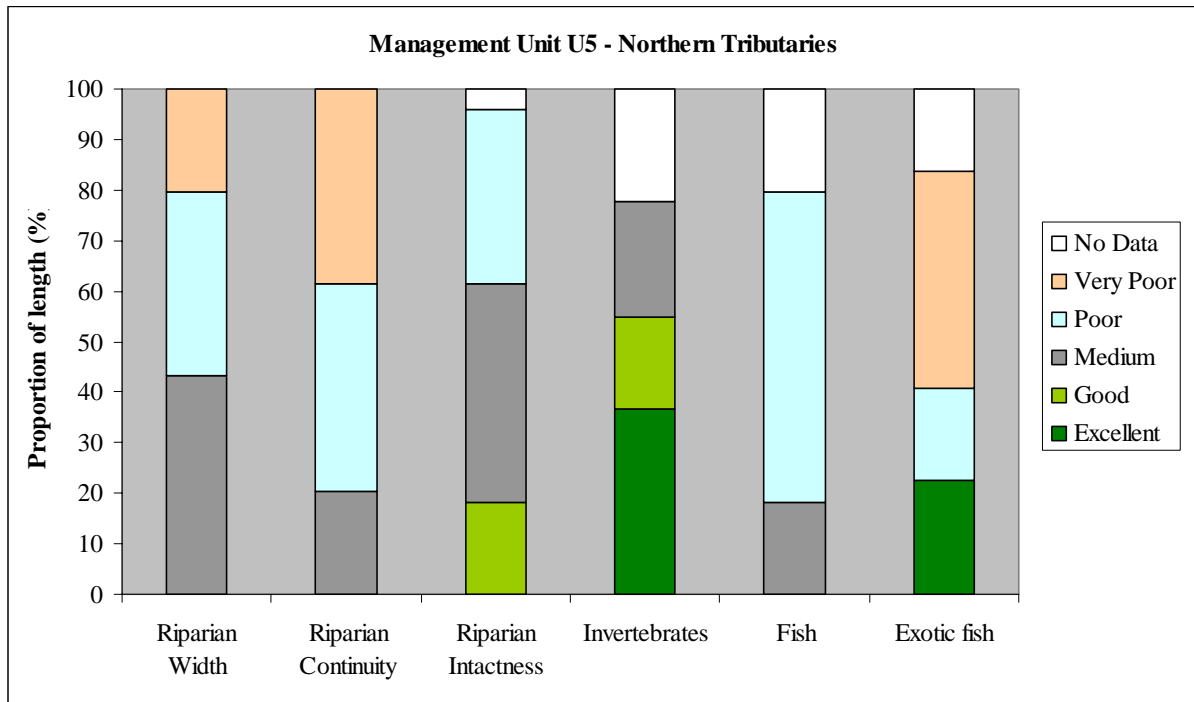


Figure 2.42. Proportion of stream length in Management Unit U1 with various Environmental Naturalness rating.

2.9.3 Social Values

Major social values in the Management Unit (Figure 2.43) are listed landscapes and European Heritage values. Only one species, Brown trout, is listed in a few reaches as of local significance. Active recreational pursuits are rare in the Management Unit.

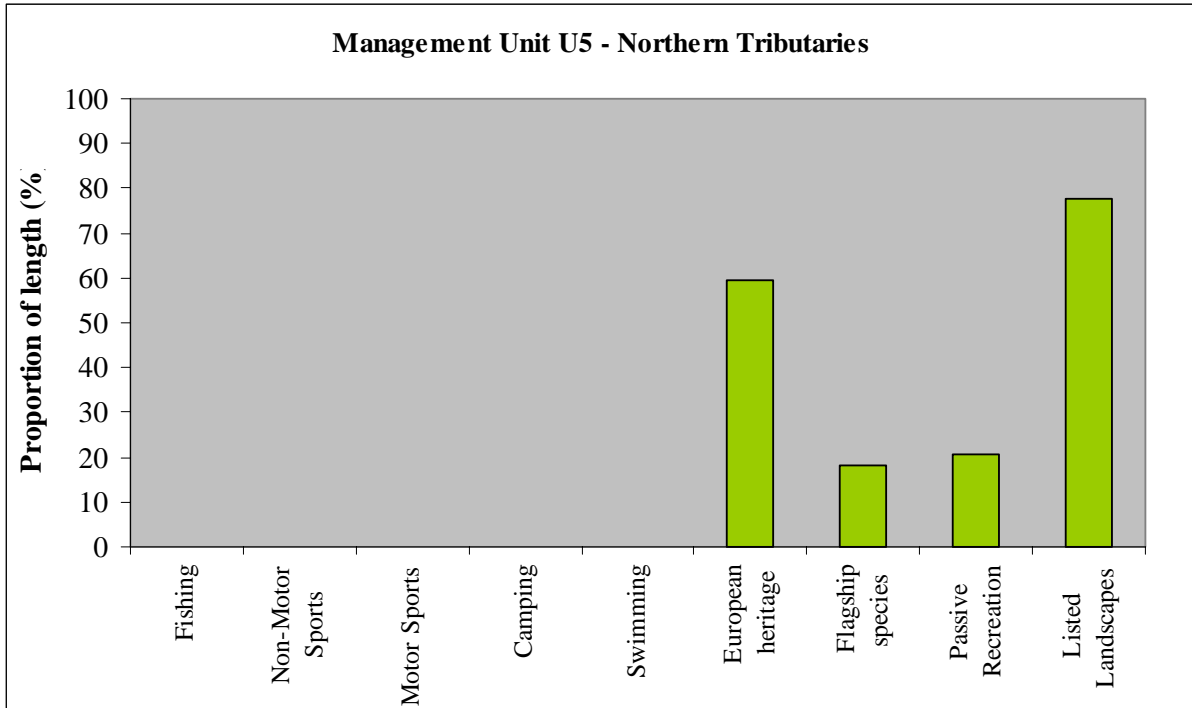


Figure 2.43. Proportion of stream length in Management Unit U5 with Very High or High Social value rating.

2.9.4 Economic values

Economic values in Management Unit U5 are high for a number of factors (Figure 2.44) with Infrastructure the most widespread (84% of the length). Water Supply Collection values are high for the streams draining into Eildon Reservoir (Merton, Brankeet and Ford Creeks). Land value is high over 61% of the Management Unit.

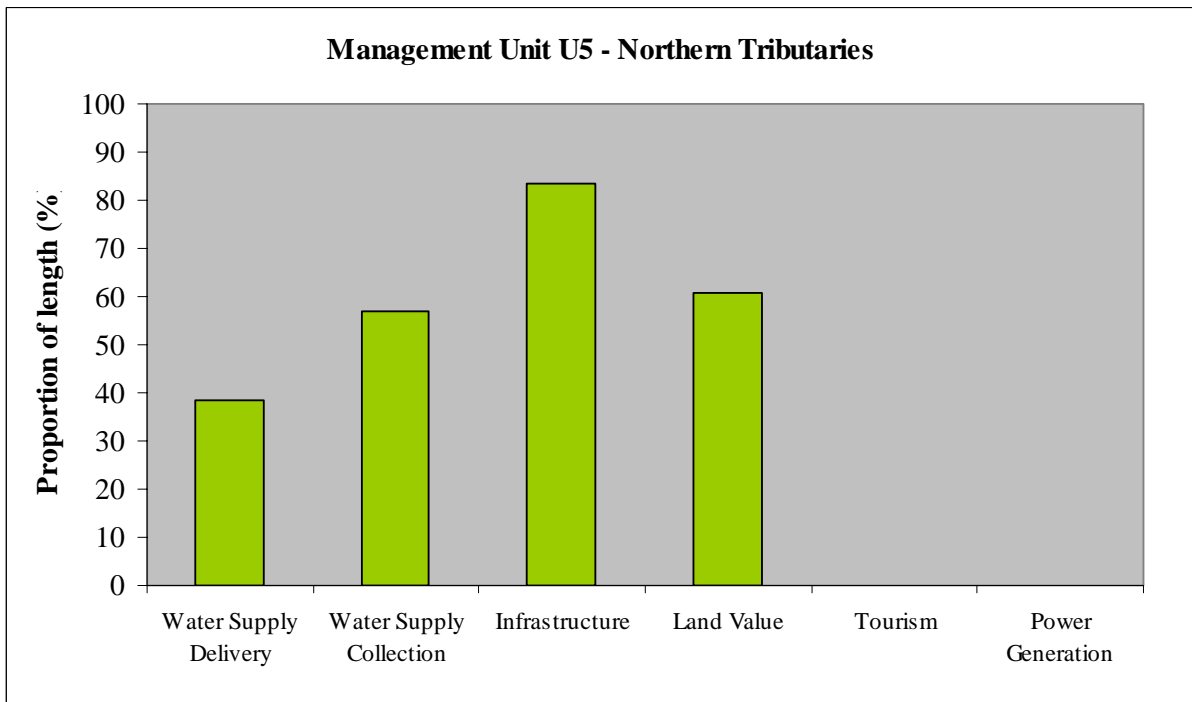


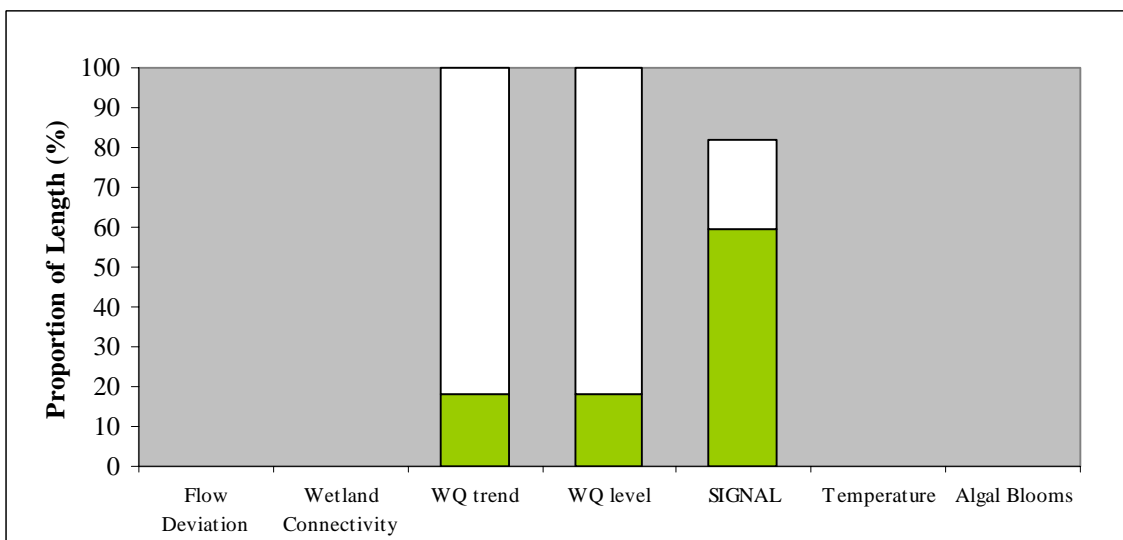
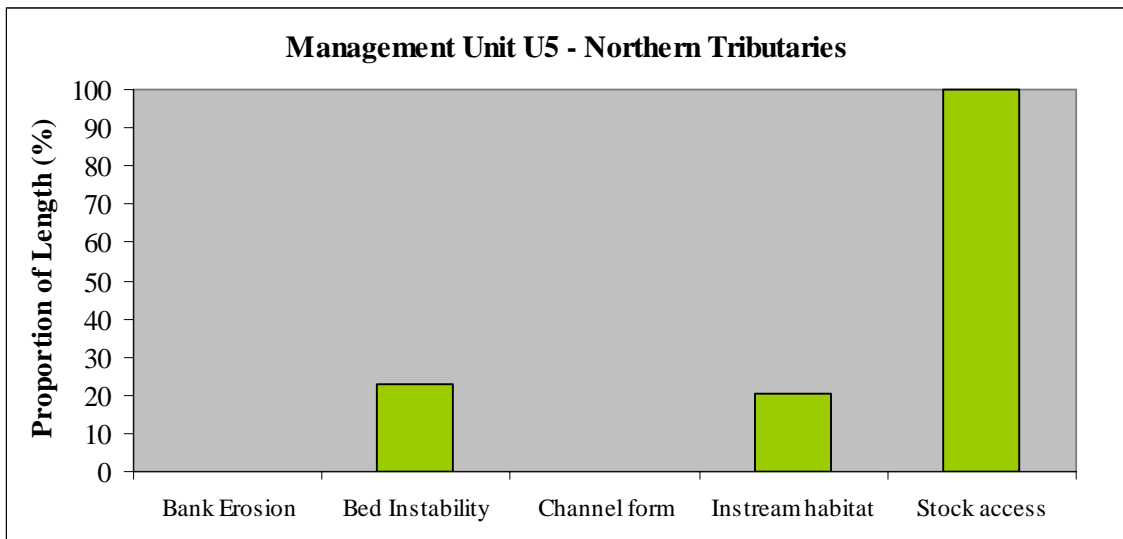
Figure 2.44. Proportion of stream length in Management Unit U5 with Very High or High Economic value rating.

2.9.5 Threats

Stock access is the main physical threat in the Management Unit (Figure 2.45), noted along the entire length of the Management Unit. No significant flow deviations occur anywhere in the Management Unit. Water quality trends and levels, where data is available (Brankeet Creek - Table 2.41) poor, while SIGNAL scores are lower than the SEPP requirements in a number of reaches. Fish passage is excluded from the entire Management Unit by Goulburn Weir or Eildon Reservoir. The streamside zone is degraded over 80% of the Management Unit. No data on exotic fauna is available and exotic flora is a high level threat in Ford Creek.

Table 2.41. Attainment of SEPP objectives for 6 water quality parameters in Management Unit U5 VWQMN sites. X - not attained, ✓ - attained, blank – insufficient data.

VWQMN Site code	Location	Nitrogen	Phosphorous	DO	pH	Turbidity	EC
405251	Brankeet Creek at Ancona	X	X	✓	✓	✓	✓



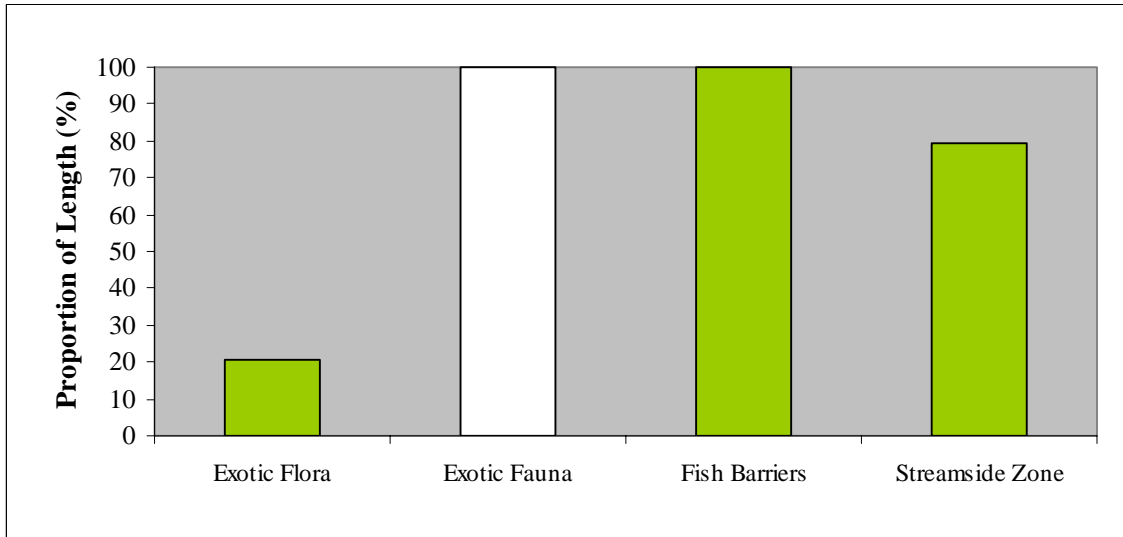


Figure 2.45. Proportion of stream length in Management Unit U5 with Very High or High Threat ratings for Physical (top), Flow and Chemical (middle) and Biological (bottom) components. Blank – No data.

2.10 Management Unit U6 – Acheron, Rubicon and Taggerty Rivers

Management Unit U6 – Acheron, Rubicon and Taggerty Rivers – covers a number of north flowing tributaries that flow into the Goulburn River downstream of Eildon Reservoir, a total length of stream of 100 km. Five reaches have been delineated that form the Management Unit.

2.10.1 Summary of Management Unit Values and Threats

The summary table for Environmental, Social and Economic values, and threat ratings for Management Unit U6 (Table 2.42) shows an overall rating for the Management Unit, based on a proportional (by reach length) average of all indices for each component from the RiVERS database.

The Index of Stream Condition scores for each ISC sub-index (Hydrology, Physical Form, Streamside Zone, Water Quality and Aquatic Life) for each reach in the Management Unit is shown in Table 2.43. Where no value for a sub-index is given, there is insufficient data to evaluate that sub-index.

Table 2.42. Summary Table for Environmental, Social and Economic values, and for threat ratings for Management Unit U6.

Environmental	Social	Economic	Threat
Moderate	Moderate	High	Low

Table 2.43. Index of Stream Condition Scores for reaches in Management Unit U6.

Reach	Stream Name	Hydrology	Physical Form	Streamside Zone	Water Quality	Aquatic Life
62	Acheron River	9				9
63	Acheron River	10	8	8		
64	Taggerty River	7	9	9		10
65	Rubicon River	10	8	5		10
66	Rubicon River	10				
	Average	9.2	8.3	7.3	n.a.	9.7

2.10.2 Environmental values

Rarity

The Acheron, Rubicon and Taggerty Rivers Management Unit (U6) has a high or very high rarity rating for significant faunal species (90% of the length), significant Ecological Vegetation Classes (100%), and wetland rarity (73% - Figure 2.46, Table 2.44). The Acheron River is nominated as a site of significance due to the large body of scientific investigations conducted in the river over many years.

The Acheron River has been suggested as a possible Representative River for the North Central uplands River Region in the VRHS (NRE, 2002). The Goulburn Broken Regional River Health Strategy suggested that the Taggerty River would be more suitable.

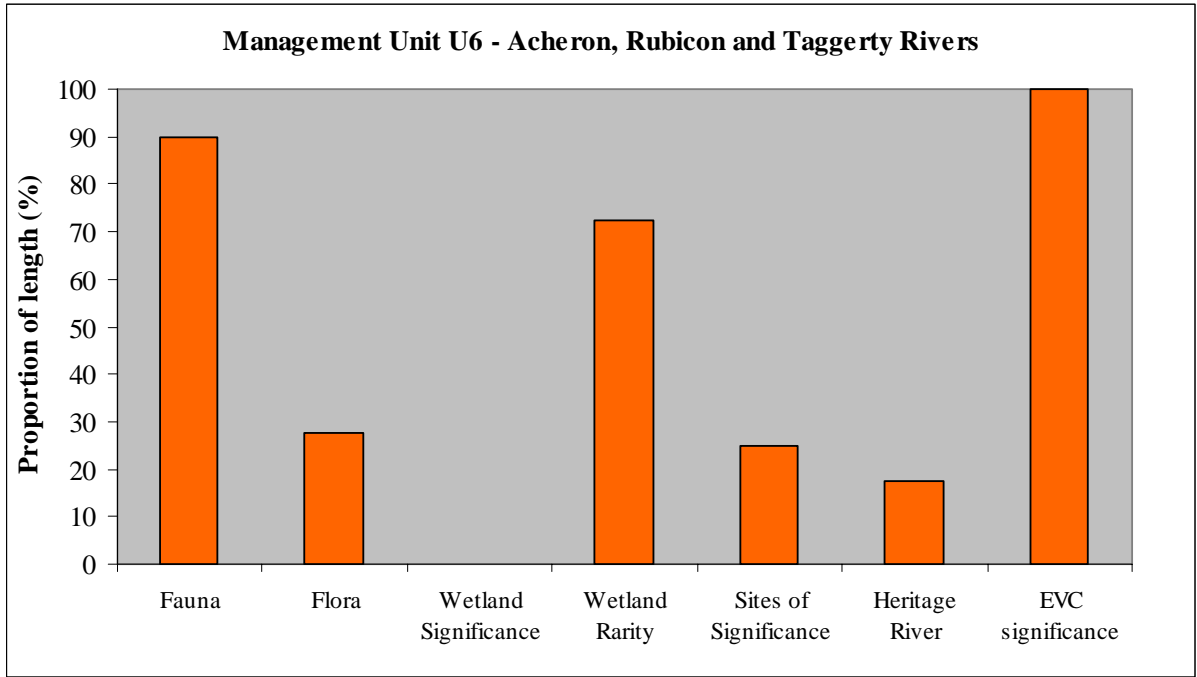


Figure 2.46. Proportion of stream length in Management Unit U6 with Very High or High Environmental Rarity rating.



Rubicon River (Reach 65)

Table 2.44. Significant fauna, flora and EVC in Management Unit U6.

Fauna	
<ul style="list-style-type: none"> • Brush-tailed phascogale • Mountain galaxias • Musk duck • Square-tailed kite • Leadbeater's possum 	<ul style="list-style-type: none"> • Murray spiny cray • Powerful owl • Sooty owl • Barred galaxias
Flora	
<ul style="list-style-type: none"> • Forest sedge 	<ul style="list-style-type: none"> • Toothed leionema
EVC	
<ul style="list-style-type: none"> • Cool Temperate Rainforest • Damp Forest • Floodplain Riparian Woodland • Grassy Dry Forest • Herb-rich Foothill Forest • Montane Damp Forest • Montane Riparian Thicket • Montane Wet Forest 	<ul style="list-style-type: none"> • Plains Grassy Woodland • Riparian Forest • Sub-alpine Woodland • Swampy Riparian Complex • Treeless Sub-alpine Mosaic • Valley Grassy Forest • Wet Forest

Naturalness

Only the Taggerty River (17.5 % of the length of the Management Unit) has high value for all riparian vegetation measures (width, continuity and structural intactness - Figure 2.47). The invertebrate community achieves SEPP requirements wherever they have been measured (Taggerty River and lower Rubicon River), and native fish communities contain all or most expected species in the Taggerty River and all of the Rubicon River (47% of the Management Unit). However, exotic fish species are common.

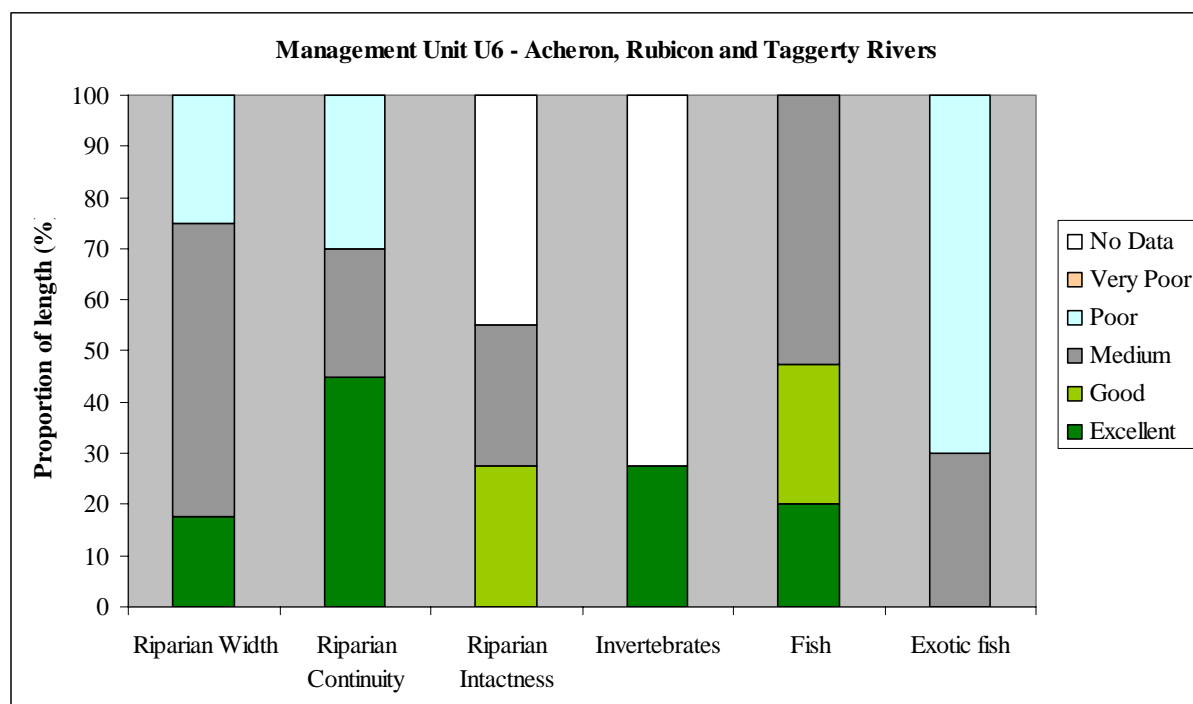


Figure 2.47. Proportion of stream length in Management Unit U1 with various Environmental Naturalness rating.

2.10.3 Social Values

Highly rated social values in the Acheron, Rubicon and Taggerty Rivers Management Unit (Figure 2.48) are widespread for fishing (over 82% of the length of the Management Unit), species of local significance (Table 2.45) and for passive recreation (72% of the length).

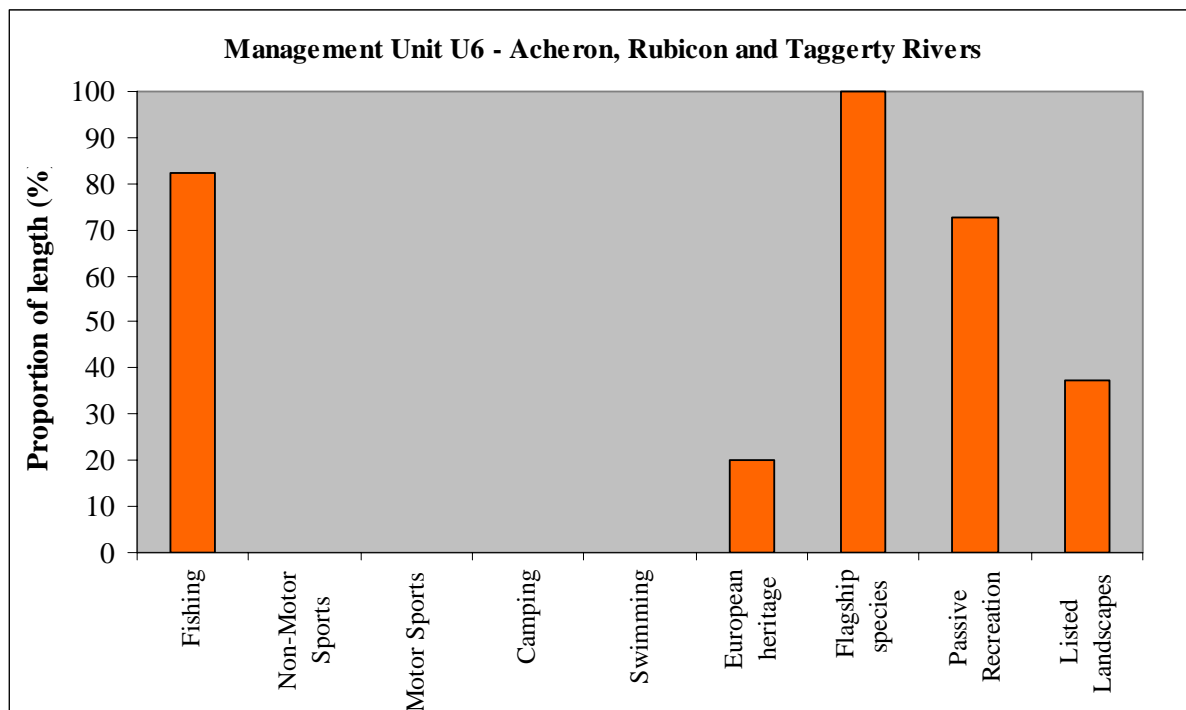


Figure 2.48. Proportion of stream length in Management Unit U6 with Very High or High Social value rating.

Table 2.45. Species of local significance found in Management Unit U6.

Barred galaxias	Lyre bird
Brown trout	Platypus
Buxton gum	Rainbow trout

2.10.4 Economic values

The economic values of water supply delivery and infrastructure are high throughout the Management Unit (Figure 2.49). Land values are high in the lower Acheron and Rubicon Rivers, with tourism of value everywhere except the upper Rubicon River. The only significant Power generation in the Goulburn Broken Catchment is located in the Rubicon River.

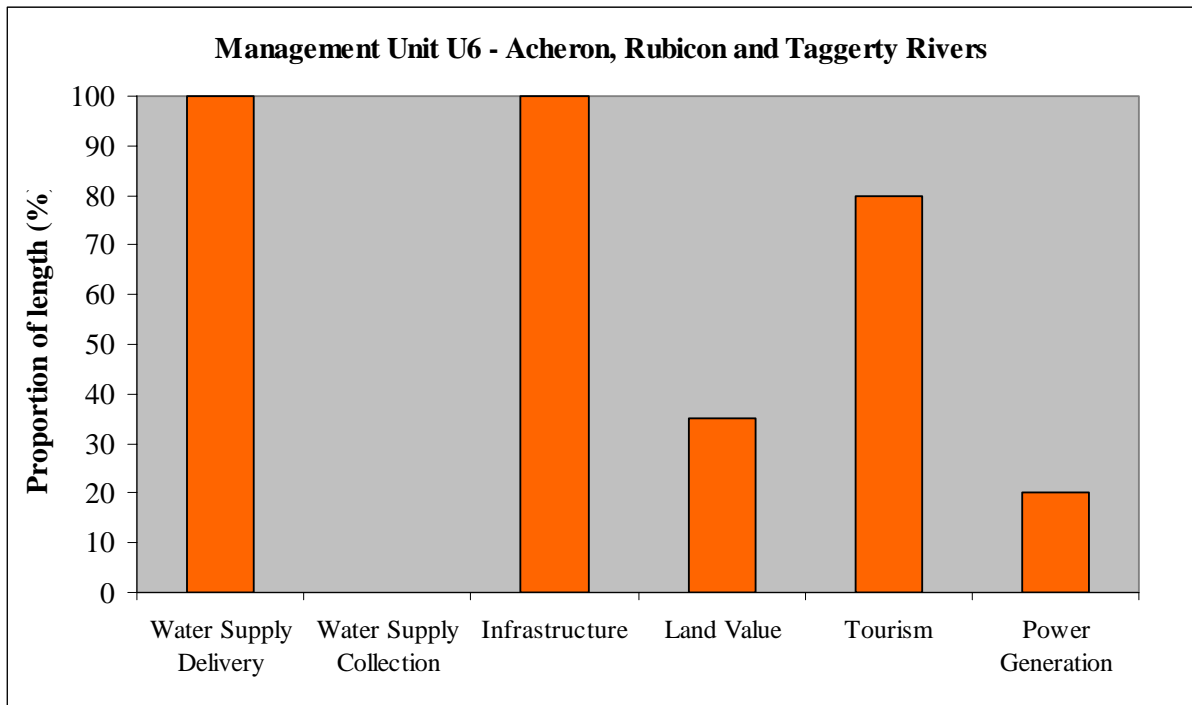


Figure 2.49. Proportion of stream length in Management Unit U6 with Very High or High Economic value rating.

2.10.5 Threats

Stock access is noted over 62% of the Management Unit (Figure 2.50), mainly in the Acheron and Rubicon valleys. Due to the Rubicon power station, flow deviation is high in parts of the Rubicon River. Limited water quality data is available, but where SIGNAL data has been collected (Taggerty and Rubicon Rivers), they achieve SEPP requirements, while phosphorous levels fail at Taggerty (Table 2.46). Downstream barriers restrict the movement of migratory fish throughout the Management Unit.

Table 2.46. Attainment of SEPP objectives for 6 water quality parameters in Management Unit U6 VWQMN sites. **X** - not attained, **✓** - attained, blank – insufficient data.

VWQMN Site code	Location	Nitrogen	Phosphorous	DO	pH	Turbidity	EC
405209	Acheron River at Taggerty	✓	X	✓	✓	✓	✓

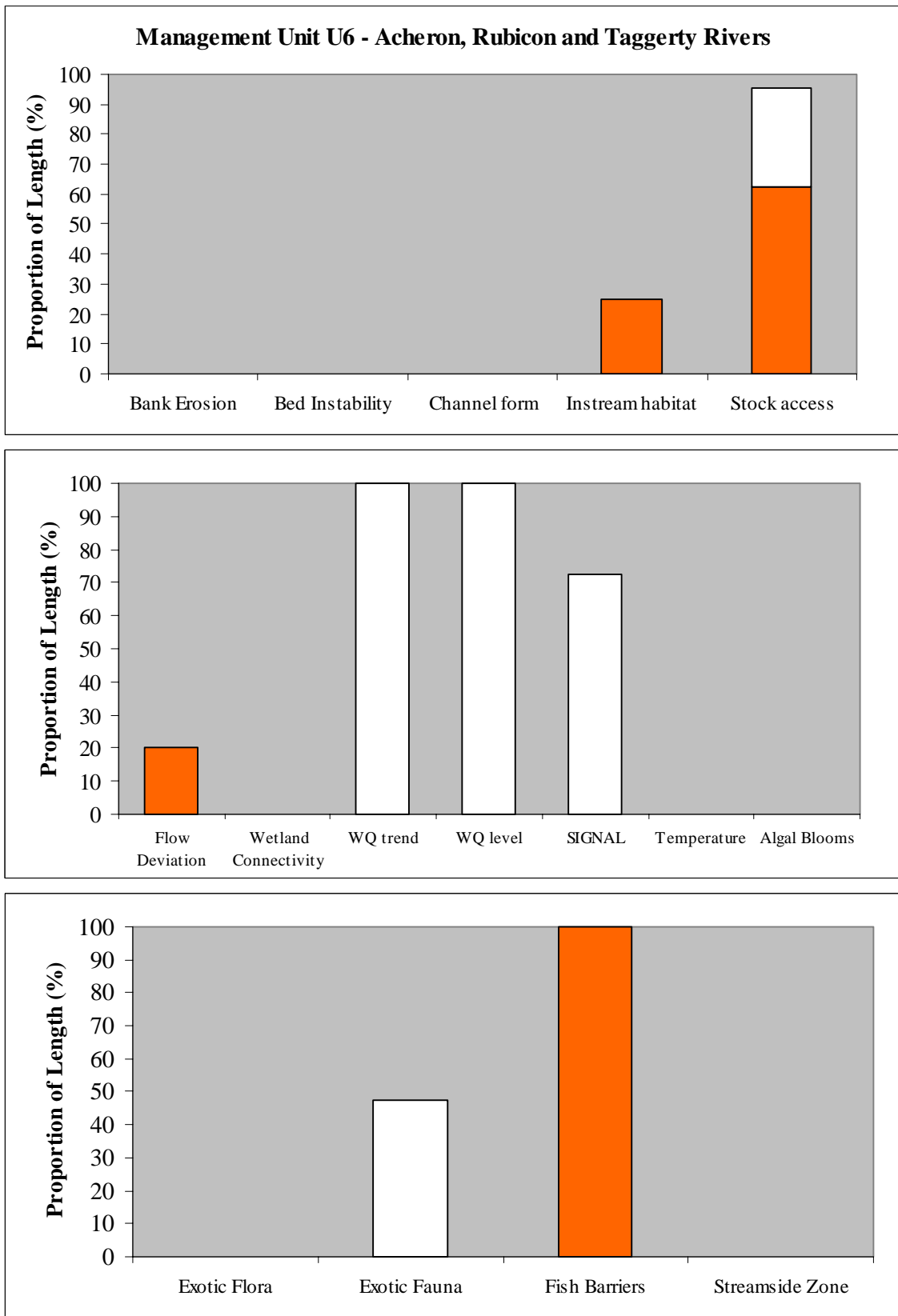


Figure 2.50. Proportion of stream length in Management Unit U6 with Very High or High Threat ratings for Physical (top), Flow and Chemical (middle) and Biological (bottom) components. Blank – No data.

2.11 Management Unit U7 – Upper Goulburn Catchment

Management Unit U7 – upper Goulburn Catchment – covers the Goulburn River and major tributaries upstream of Eildon Reservoir, a total length of stream of 200 km. Eight reaches have been delineated that form the Management Unit.

2.11.1 Summary of Management Unit Values and Threats

The summary table for Environmental, Social and Economic values, and threat ratings for Management Unit U7 (Table 2.47) shows an overall rating for the Management Unit, based on a proportional (by reach length) average of all indices for each component from the RiVERS database.

The Index of Stream Condition scores for each ISC sub-index (Hydrology, Physical Form, Streamside Zone, Water Quality and Aquatic Life) for each reach in the Management Unit is shown in Table 2.48. Where no value for a sub-index is given, there is insufficient data to evaluate that sub-index.

Table 2.47. Summary Table for Environmental, Social and Economic values, and for threat ratings for Management Unit U7.

Environmental	Social	Economic	Threat
Moderate	High	High	Low

Table 2.48. Index of Stream Condition Scores for reaches in Management Unit U7.

Reach	Stream Name	Hydrology	Physical Form	Streamside Zone	Water Quality	Aquatic Life
15	Goulburn River	10	8	8	10	10
16	Goulburn River	10	7	4		10
67	Big River	10	9	9		
68	Big River	10	8	10	9	10
69	Howqua River	10	8	9		
70	Howqua River	10	7	7		10
71	Delatite River	10	6	3	9	9
72	Delatite River	10				
	Average	10.0	7.6	7.1	9.3	9.8

2.11.2 Environmental values

Rarity

The upper Goulburn Catchment Management Unit (U7) mainly has high or very high environmental rarity ratings for significant faunal species (95% of the length) and for Heritage Rivers (Figure 2.51, Table 2.49), for parts of the Big and Howqua Rivers (LCC, 1991).

The Goulburn Broken Regional River Health Strategy suggested that the upper Big River would be suitable as a representative river for the Alpine River Region.

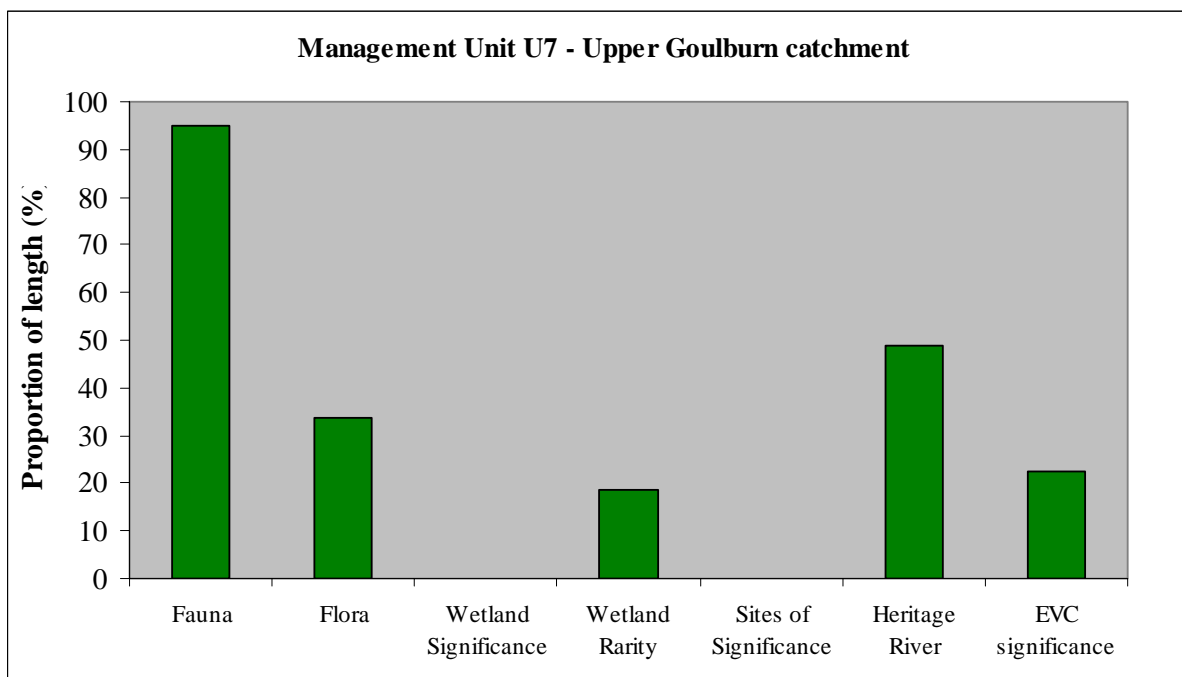


Figure 2.51. Proportion of stream length in Management Unit U7 with Very High or High Environmental Rarity rating.

Table 2.49. Significant fauna, flora and EVC in Management Unit U7.

Fauna	
<ul style="list-style-type: none"> • Common bent-wing bat • Macquarie perch • Mountain galaxias • Murray cod • Powerful owl 	<ul style="list-style-type: none"> • Sooty owl • Southern myotis • Spotted tree frog • Tree goanna
Flora	
<ul style="list-style-type: none"> • Alpine bent • Cliff cudweed 	<ul style="list-style-type: none"> • Netted daisy-bush • Royal grevillea
EVC	
<ul style="list-style-type: none"> • Damp Forest • Floodplain Riparian Woodland • Grassy Dry Forest • Grassy Woodland • Heathy Dry Forest • Herb-rich Foothill Forest • Montane Damp Forest • Montane Dry Woodland • Montane Riparian Thicket • Montane Wet Forest 	<ul style="list-style-type: none"> • Plains Grassy Woodland • Riparian Forest • Riparian Forest/Swampy Riparian Woodland/Riparian Shrubland/Riverine Escarpment Scrub/Disturbed Mosaic • Riverine Escarpment Scrub • Shrubby Dry Forest • Sub-alpine Woodland • Valley Grassy Forest • Wet Forest

Naturalness

In the lower Goulburn and Big Rivers, high value for two main riparian vegetation measures (width and continuity - Figure 2.52) have been recorded. Most other sites have high value for riparian continuity, but not for structural intactness. The invertebrate community achieves most or all of the SEPP requirements where it has been measured. Native fish communities are natural or near natural

in the Goulburn, Big and Delatite Rivers (but not in the Howqua). Exotic fish species are common throughout.

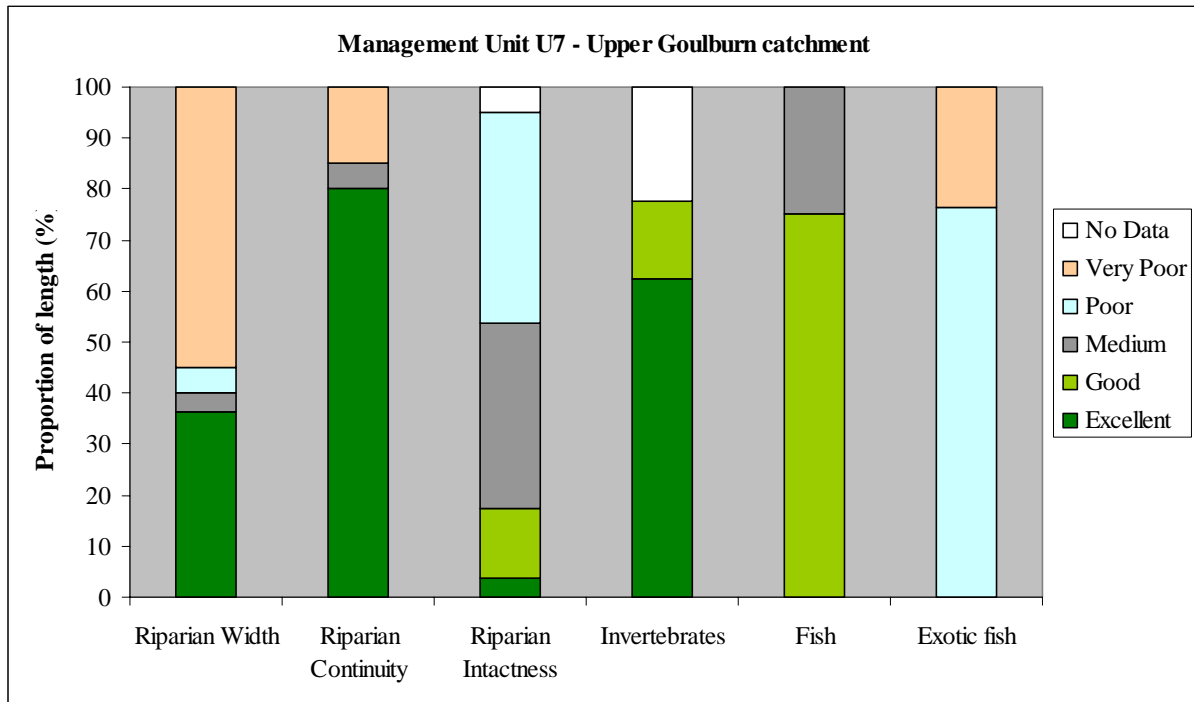


Figure 2.52. Proportion of stream length in Management Unit U1 with various Environmental Naturalness rating.

2.11.3 Social Values

A number of social values in the upper Goulburn catchment Management Unit (U7) have high or very high ratings over large proportions of the Management Unit (Figure 2.53). European Heritage, species of local significance (Table 2.50) and passive recreation are all high value social assets over more than 70% of the Management Unit. Non-motor sports (canoeing) and camping are also popular.

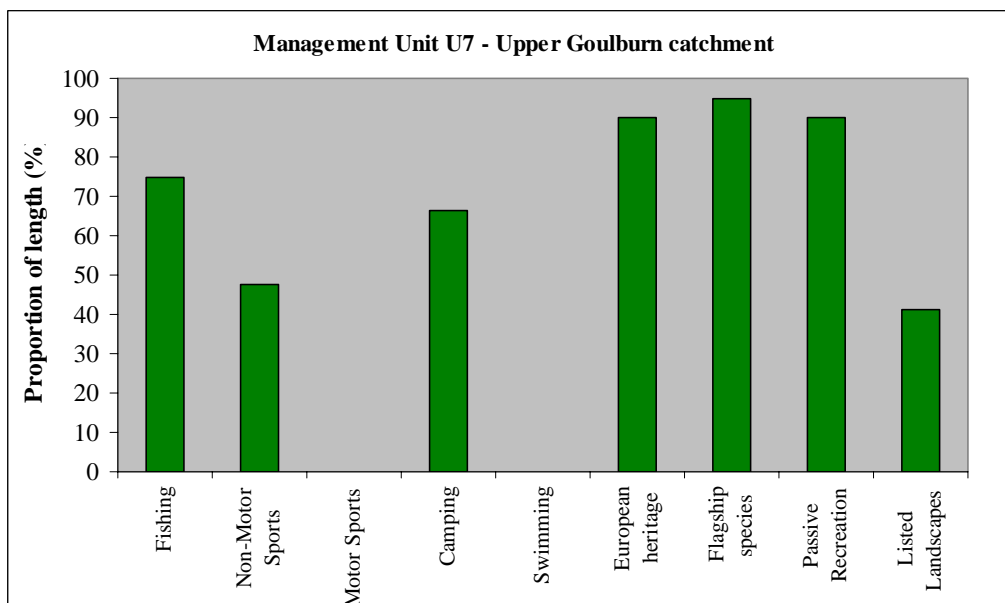


Figure 2.53. Proportion of stream length in Management Unit U7 with Very High or High Social value rating.

Table 2.50. Species of local significance found in Management Unit U7.

Barred galaxias	Platypus
Brown trout	Rainbow trout
Cray fish	Spiny freshwater crayfish
Mountain galaxias	Spotted tree frog

2.11.4 Economic values

Water supply delivery and collection are high values throughout the Management Unit (Figure 2.54). Infrastructure is high value everywhere, except the upper Big and Howqua Rivers, and tourism is highly valued over 90% of the Management Unit (except the upper Big River).

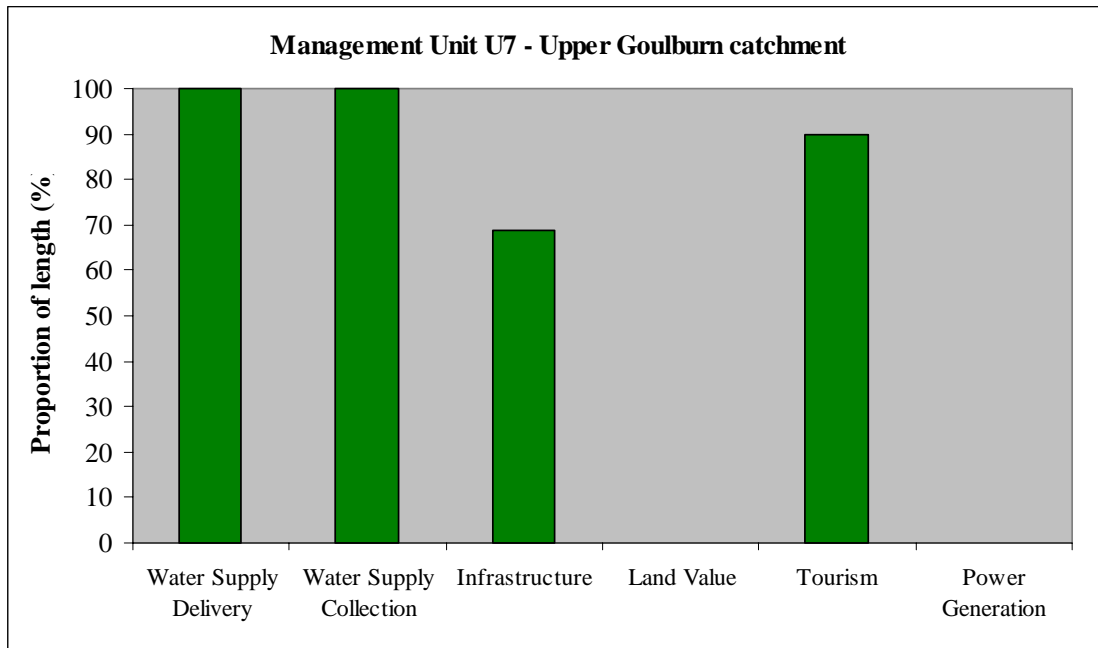


Figure 2.54. Proportion of stream length in Management Unit U7 with Very High or High Economic value rating.

2.11.5 Threats

Few physical threats are found in the upper Goulburn catchment Management Unit U7 (Figure 2.55) with unrestricted stock access and bed instability only recorded from the Delatite River. No significant flow deviations are noted in the Management Unit, and water quality levels fail one SEPP objective wherever they have been measured (Table 2.51). However, the lower Goulburn, lower Delatite and upper Big River reaches show significant trends in water quality.

Eildon Reservoir forms a permanent barrier to all fish species. Exotic flora and degraded streamside vegetation are noted from the upper Goulburn and lower Delatite Rivers.

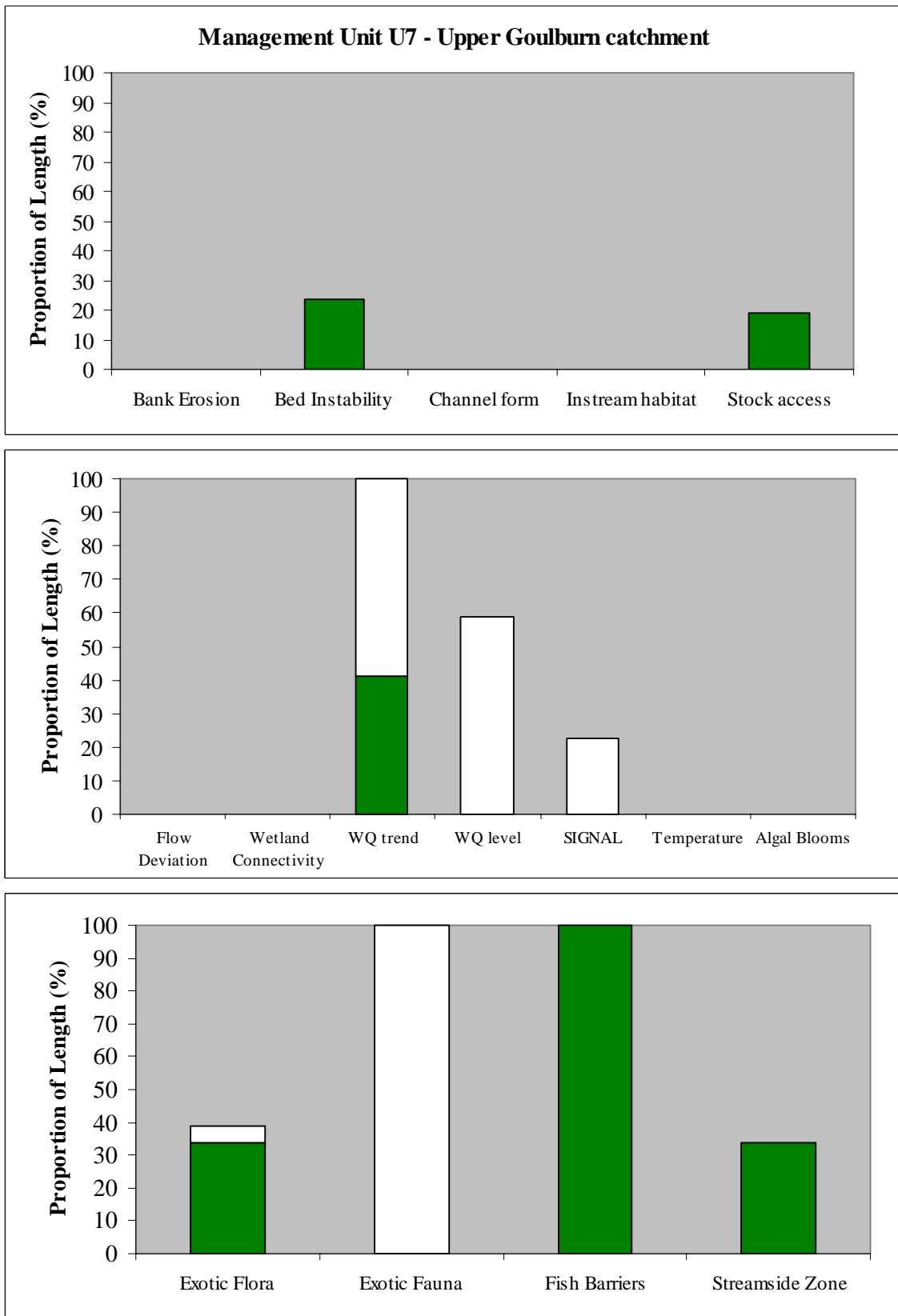


Figure 2.55. Proportion of stream length in Management Unit U7 with Very High or High Threat ratings for Physical (top), Flow and Chemical (middle) and Biological (bottom) components. Blank – No data.

Table 2.51. Attainment of SEPP objectives for 6 water quality parameters in Management Unit U7 VWQMN sites. X - not attained, ✓ - attained, blank – insufficient data.

VWQMN Site code	Location	Nitrogen	Phosphorous	DO	pH	Turbidity	EC
405214	Delatite River at Tonga Bridge	✓	X	✓	✓	✓	✓
405219	Goulburn River at Dohertys	✓	✓	X	✓	✓	✓
405264	Big River d/s of Frenchman Creek	✓	X	✓	✓	✓	✓

3. Waterways in Focus – The Broken Basin

3.1 Management Unit L2 – Lower Broken Creek

Management Unit L2 – Lower Broken Creek – covers the lower sections of Broken Creek downstream of Katamatite, as well as all of Pine Lodge Creek and the lower reach of Nine Mile Creek. The total length of stream in the Management Unit is 210 km. Seven reaches have been identified in the Management Unit.

3.1.1 Summary of Management Unit Values and Threats

The summary table for Environmental, Social and Economic values, and threat ratings for Management Unit L2 (Table 2.1) shows an overall rating for the Management Unit, based on a proportional (by reach length) average of all indices for each component from the RiVERS database.

The Index of Stream Condition scores for each ISC sub-index (Hydrology, Physical Form, Streamside Zone, Water Quality and Aquatic Life) for each reach in the Management Unit is shown in Table 2.2. Where no value for a sub-index is given, there is insufficient data to evaluate that sub-index.

Table 3.1. Summary Table for Environmental, Social and Economic values, and for threat ratings for Management Unit L2.

Environmental	Social	Economic	Threat
Moderate	Moderate	High	Low

Table 3.2. Index of Stream Condition Scores for reaches in Management Unit L2.

Reach	Stream Name	Hydrology	Physical Form	Streamside Zone	Water Quality	Aquatic Life
21	Broken Creek	2	9	6	7	
22	Broken Creek	2	8	5		6
23	Broken Creek	2	5	5		6
24	Broken Creek	2	6	6	7	
28	Nine Mile Creek	10	5	7		6
30	Pine Lodge Creek	9	4	4		
31	Pine Lodge Creek	10	5	4		
	Average	5.3	6.0	5.3	7.0	6.0

3.1.2 Environmental values

Rarity

The Lower Broken Creek Management Unit (L2) has a high or very high rarity rating over much of its length for a number of different values (Figure 2.1). Significant faunal and flora species and Ecological Vegetation Classes (EVC) are found within 100m of the river over much of the Management Unit (Table 2.3, Figure 2.1). Significant and rare wetlands are found along the Broken Creek part of the Management Unit, including the Barmah forest.

There are no representative rivers listed in the Management Unit.

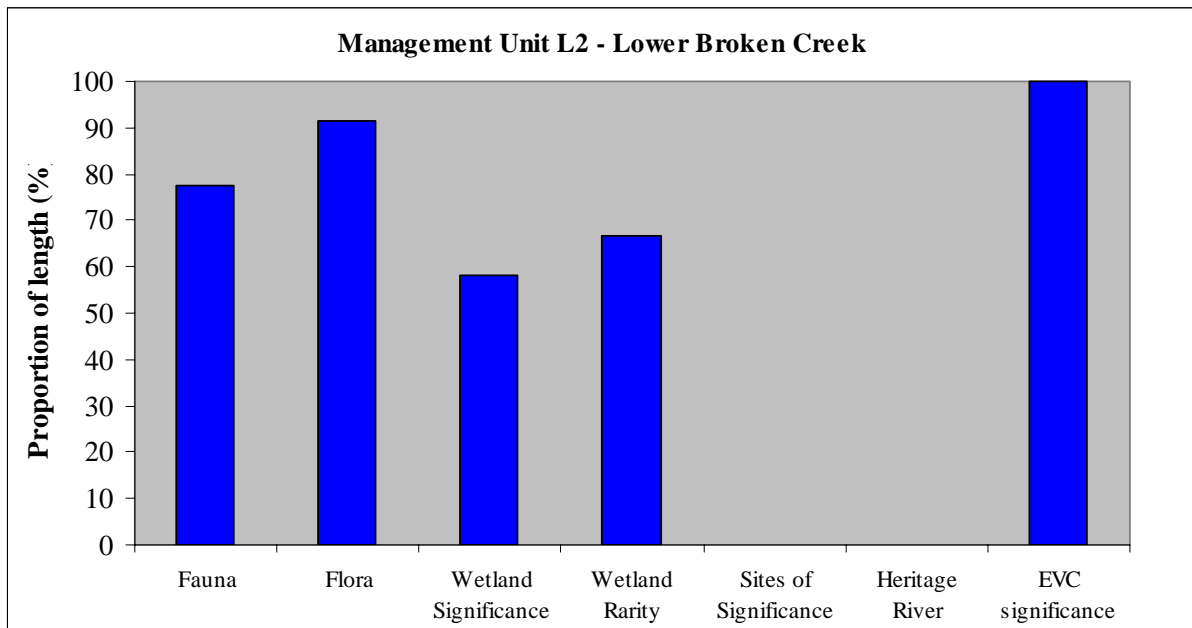


Figure 3.1. Proportion of stream length in Management Unit L2 with Very High or High Environmental Rarity rating.

Table 3.3. Significant fauna, flora and EVC in Management Unit L2.

Fauna	
<ul style="list-style-type: none"> • Barking Marsh Frog • Bush Stone-curlew • Diamond Firetail • Great Egret • Hardhead 	<ul style="list-style-type: none"> • Royal Spoonbill • Squirrel Glider • Tree Goanna • Woodland Blind Snake
Flora	
<ul style="list-style-type: none"> • Austral Trefoil • Bluish Raspwort • Buloke • Common Joyweed • Forde Poa • Late-flower Flax-lily • Leafy Templetonia • Leafy Wallaby-grass • Mallee Golden Wattle 	<ul style="list-style-type: none"> • Matted Water-starwort • Silky Browntop • Small Scurf-pea • Smooth Minuria • Spiny-fruit Saltbush • Spurred Spear-grass • Tough Scurf-pea • Waterbush • Woolly Buttons
EVC	
<ul style="list-style-type: none"> • Black Box Chenopod Woodland • Box Ironbark Forest • Creekline Grassy Woodland • Creekline Grassy Woodland/Red Gum Wetland Mosaic • Drainage Line Complex • Pine Box Woodland • Pine Box Woodland/Riverina Plains Grassy Woodland Mosaic • Plains Grassy Wetland • Plains Grassy Woodland 	<ul style="list-style-type: none"> • Plains Grassy Woodland/Gilgai Plains Woodland/Wetland Mosaic • Red Gum Wetland/Plains Grassy Wetland Mosaic • Riverine Grassy Woodland • Riverine Grassy Woodland/Black Box Chenopod Woodland/Wetland Mosaic • Riverine Grassy Woodland/Riverine Sedgy Forest/Wetland Mosaic • Unclassified Lunette Woodland • Wetland Formation



Broken Creek (Reach 23)

Naturalness

Riparian width is Excellent over only 14% of the reach (all in Nine Mile Creek - Figure 2.2). Continuity is high value over 23% of the reach (all in Broken Creek), while riparian structure is only Moderate or Poor throughout the reach. Little invertebrate data is available, but no sites rate highly (one site on Broken Creek and Nine Mile Creek). The native fish community has close to an expected composition only over the lower portions of Broken Creek. Introduced fish species are common throughout the reach.

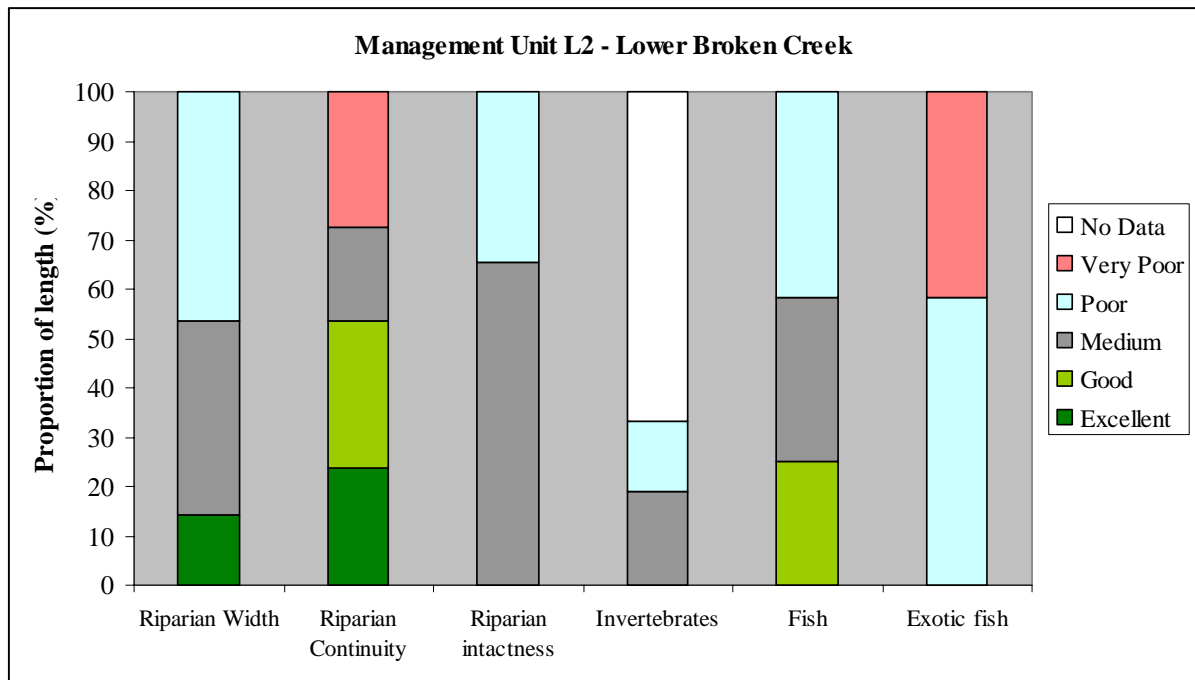


Figure 3.2. Proportion of stream length in Management Unit L2 with various Environmental Naturalness rating.

3.1.3 Social Values

A number of social values are found within the Management Unit, although many are localized and not widespread (Figure 2.3). Most of the social activities (fishing, sports, camping and passive recreation) are found along the Broken Creek section of the Management Unit. A number of species of local significance species (those with special community significance rather than necessarily of conservation significance) are recorded from the Management Unit (Table 2.4) .

3.1.4 Economic values

Three economic values – Water supply delivery, infrastructure and land value rate highly throughout almost the entire Management Unit (Figure 2.4). Tourism is also a valuable economic asset over the upper section of Broken Creek in the Management Unit.

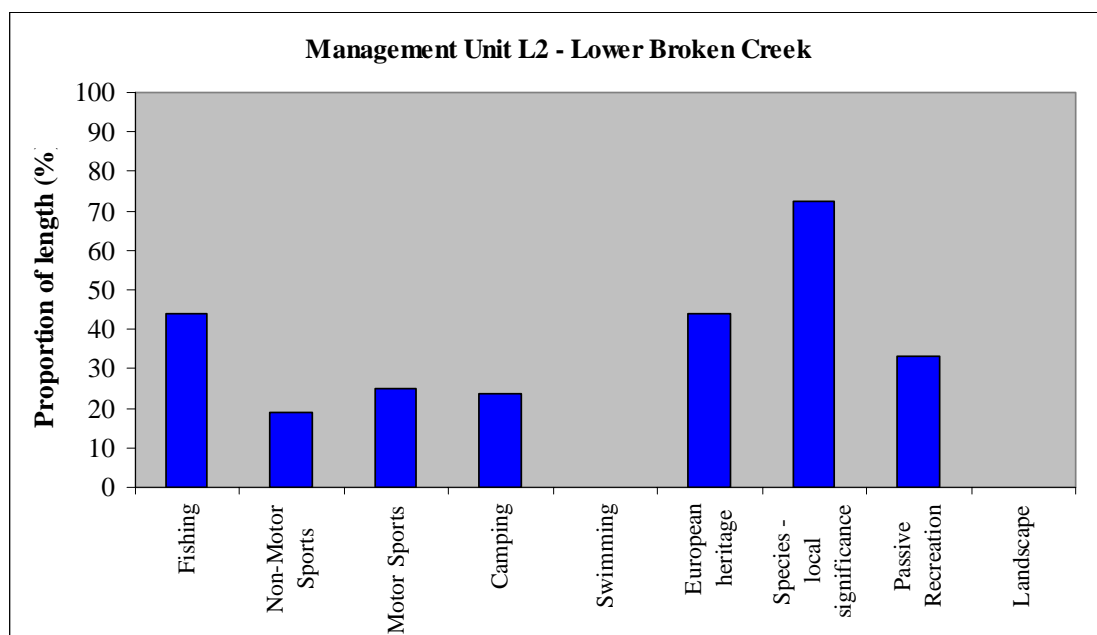


Figure 3.3. Proportion of stream length in Management Unit L2 with Very High or High Social value rating.

Table 3.4. Species of local significance found in Management Unit L2.

Black duck	Murray cod
Grey box	River redgum
Grey crown babbler	Superb parrot
Kingfisher	Yabbie

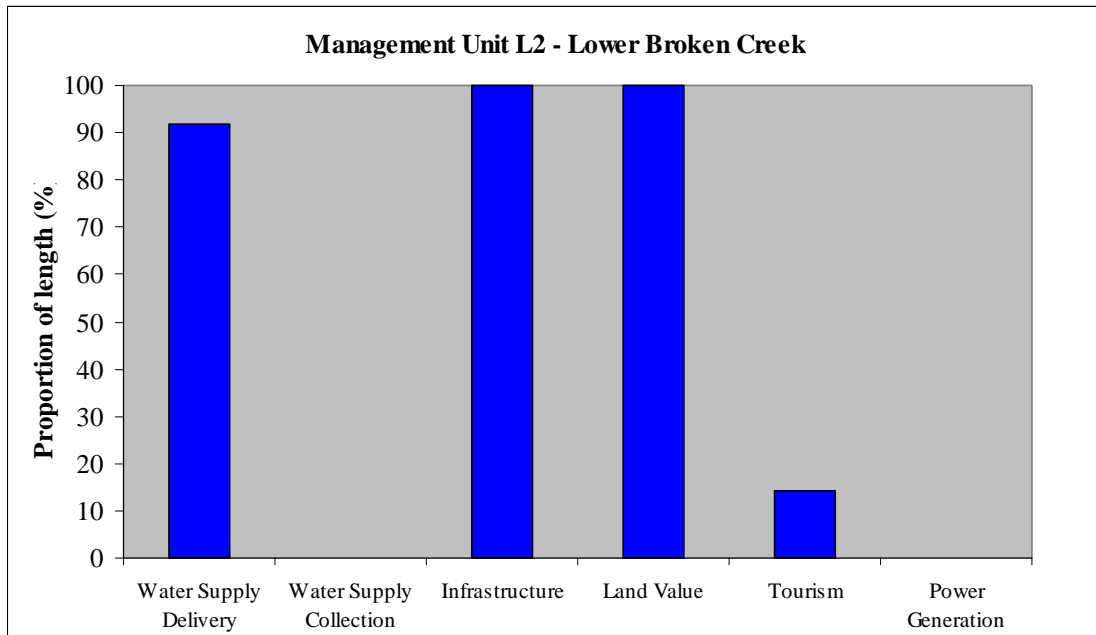
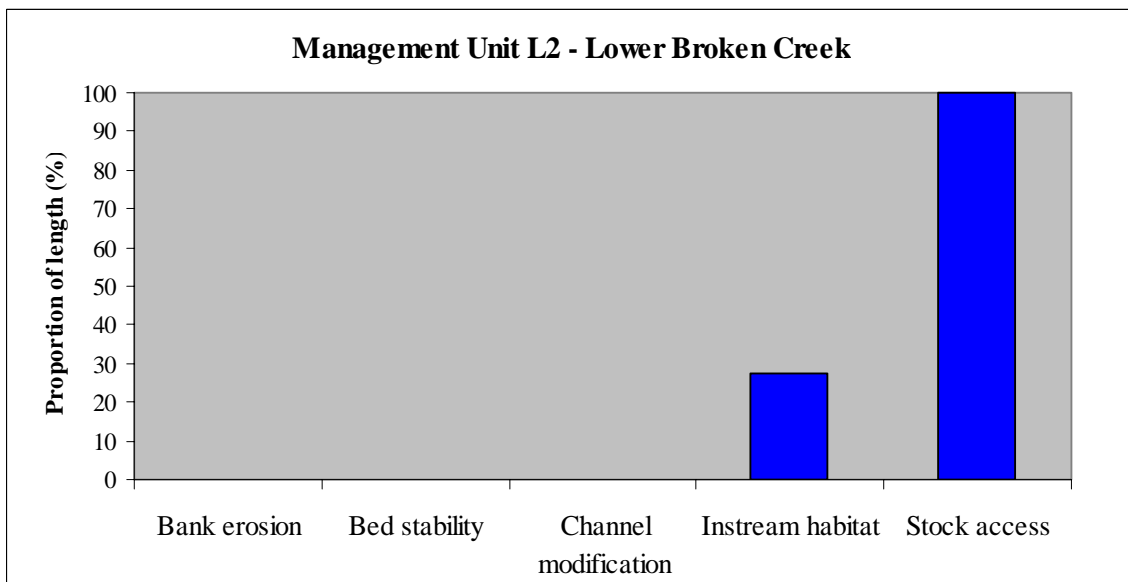


Figure 3.4. Proportion of stream length in Management Unit L2 with Very High or High Economic value rating.

3.1.5 Threats

Stock access is the main physical threat in the Management Unit, noted over all the length (Figure 2.5), with poor instream habitat in Pine Lodge creek. Flow deviation is significant in the lower Broken Creek. No water quality data is available for most of the Management Unit, but fail most SEPP objectives where they have been measured (Table 3.5). Algal blooms have been recorded in lower Broken Creek. Few biological threats are found in the Management Unit, with poor streamside zone conditions restricted to Pine Lodge Creek. There is no data on exotic fauna.



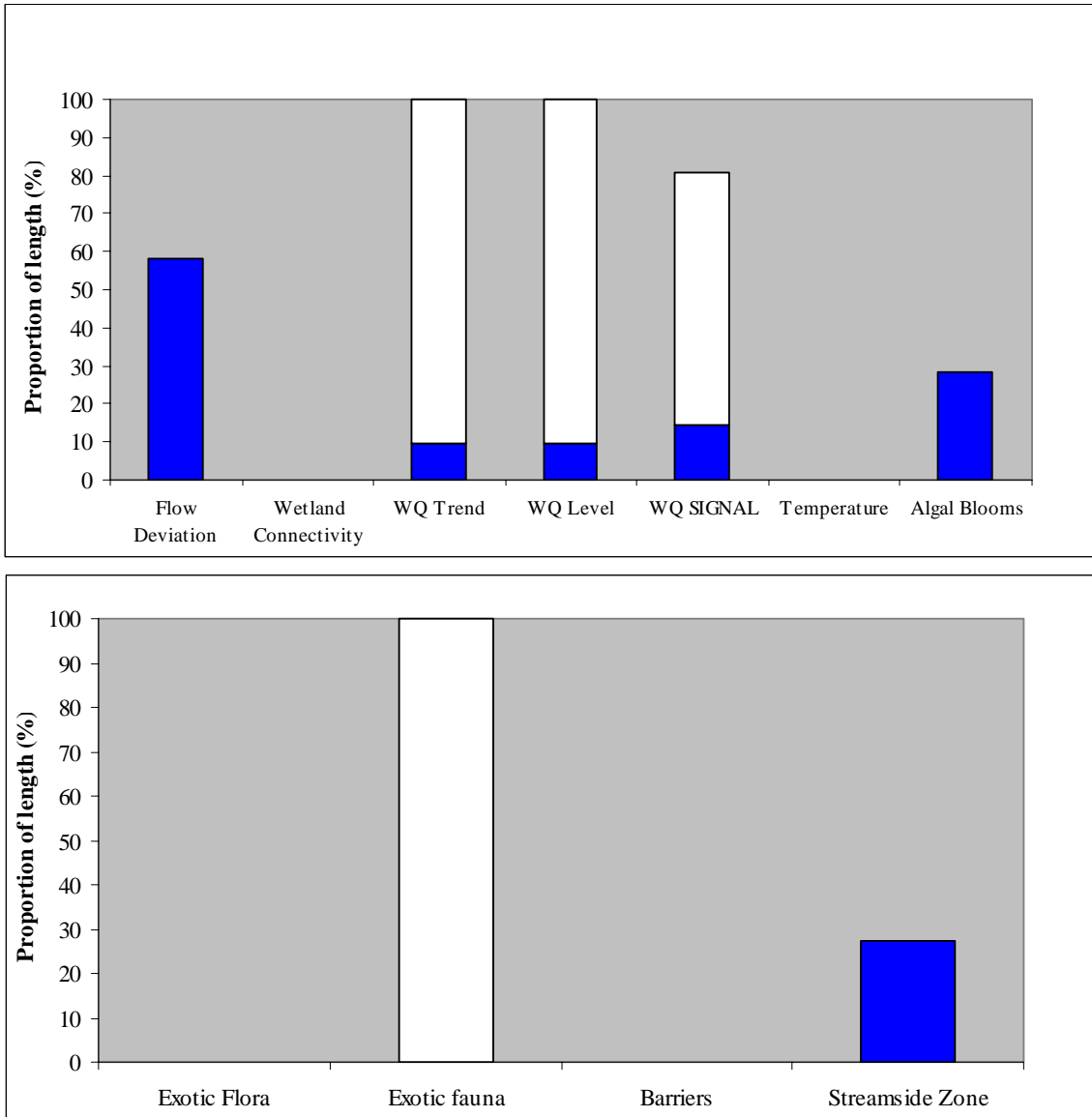


Figure 3.5. Proportion of stream length in Management Unit L2 with Very High or High Threat ratings for Physical (top), Flow and Chemical (middle) and Biological (bottom) components. Blank – No data.

Table 3.5. Attainment of SEPP objectives for 6 water quality parameters in Management Unit L2 VWQMN sites. X - not attained, ✓ - attained, blank – insufficient data.

VWQMN Site code	Location	Nitrogen	Phosphorous	DO	pH	Turbidity	EC
404210	Broken Creek at Rices Weir	X	X		✓	X	✓

3.2 Management Unit L5 – Lower Broken River

Management Unit L5 – Lower Broken River – covers the lower Broken River, downstream from Casey’s Weir through to the confluence with the Goulburn River. The total length of stream in the Management Unit is 62.5 km. Three reaches have been identified in the Management Unit (including one urban reach not included in the ISC).

3.2.1 Summary of Management Unit Values and Threats

The summary table for Environmental, Social and Economic values, and threat ratings for Management Unit L5 (Table 3.6) shows an overall rating for the Management Unit, based on a proportional (by reach length) average of all indices for each component from the RiVERS database.

The Index of Stream Condition scores for each ISC sub-index (Hydrology, Physical Form, Streamside Zone, Water Quality and Aquatic Life) for each reach in the Management Unit is shown in (Table 3.7). Where no value for a sub-index is given, there is insufficient data to evaluate that sub-index.

Table 3.6. Summary Table for Environmental, Social and Economic values, and for threat ratings for Management Unit L5.

Environmental	Social	Economic	Threat
Moderate	Moderate	High	Moderate

Table 3.7. Index of Stream Condition Scores for reaches in Management Unit L5.

Reach	Stream Name	Hydrology	Physical Form	Streamside Zone	Water Quality	Aquatic Life
1	Broken River	0	5	7	7	8
2	Broken River	0	5	7		6
	Average	0.0	5.0	7.0	7.0	7.0



Broken River (Reach 1)

3.2.2 Environmental values

Rarity

The Lower Broken River Management Unit (L5) has high levels of environmental rarity for fauna, wetlands and EVC (Figure 3.6). Two significant fish species and significant Ecological Vegetation Classes are found over all of the Management Unit (Table 3.8).

There are no representative rivers listed in the Management Unit.

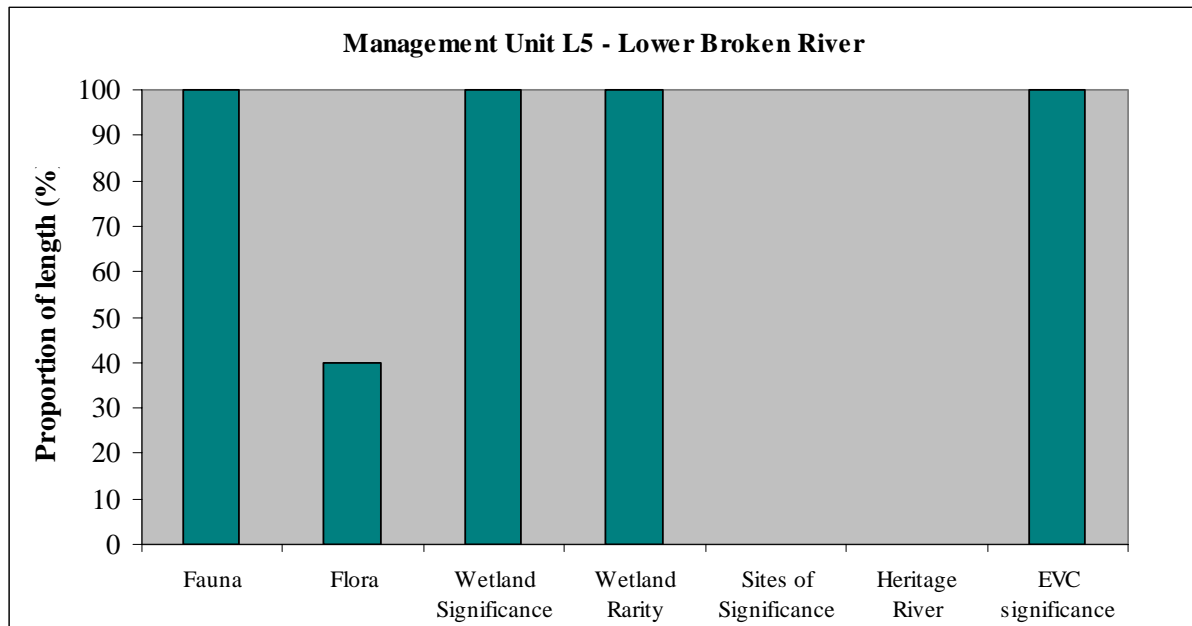


Figure 3.6. Proportion of stream length in Management Unit L5 with Very High or High Environmental Rarity rating.

Table 3.8. Significant fauna, flora and EVC in Management Unit L5.

Fauna	
• Crimson-spotted rainbowfish	• Golden perch
Flora	
• Silky browntop	
EVC	
• Floodplain Riparian Woodland	• Riverine Grassy Woodland/Riverine Sedgy
• Gilgai Plain Woodland/Wetland Mosaic	• Forest/Wetland Mosaic
• Plains Grassy Woodland	• Sand Ridge Woodland

Naturalness

Riparian width and continuity is in Excellent or Good condition over the entire Management Unit (Figure 3.7), although structural intactness is only rated as Medium. Invertebrate data is restricted to only one site, where poor community characters were found. Similarly, the native fish community is missing many expected species and exotic fish dominate throughout.

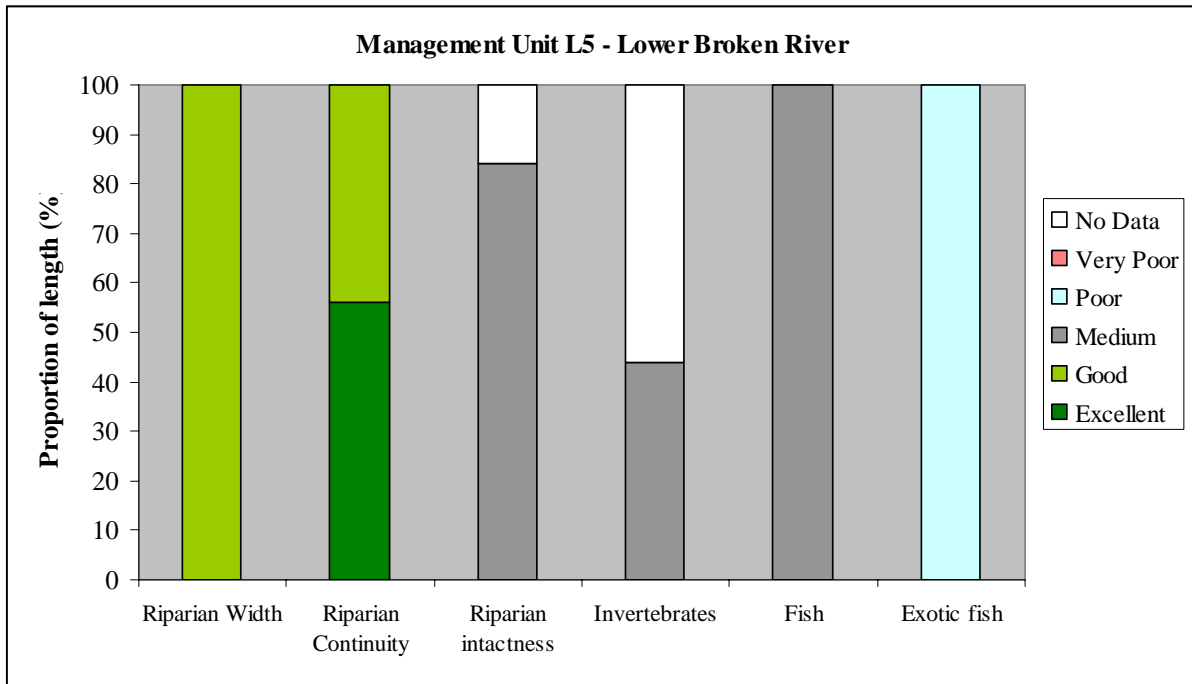


Figure 3.7. Proportion of stream length in Management Unit L5 with various Environmental Naturalness rating.

3.2.3 Social Values

The Lower Broken River has high social values for passive recreation (over the entire reach) and for fishing (rated as popular in the upper part of the Management Unit – 44% of the length - Figure 3.8). A number of species of local significance species are also known to inhabit the Management Unit (Table 3.9) .

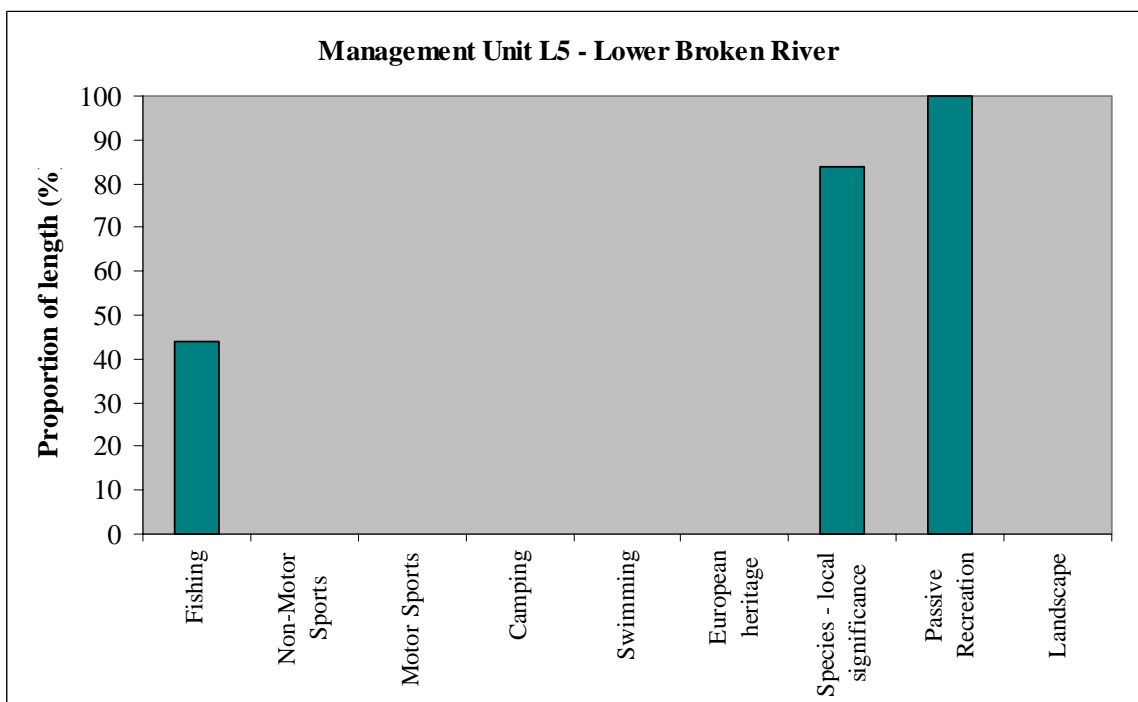


Figure 3.8. Proportion of stream length in Management Unit L5 with Very High or High Social value rating.

Table 3.9. Species of local significance found in Management Unit L5.

Murray cod	Platypus
Murray cray Fish	Yabbie

3.2.4 Economic values

Three economic values – Water supply delivery, infrastructure and land value rate highly throughout almost the entire Management Unit (Figure 3.9). Tourism is also a valuable economic asset in the urban section of the Management Unit (Shepparton).

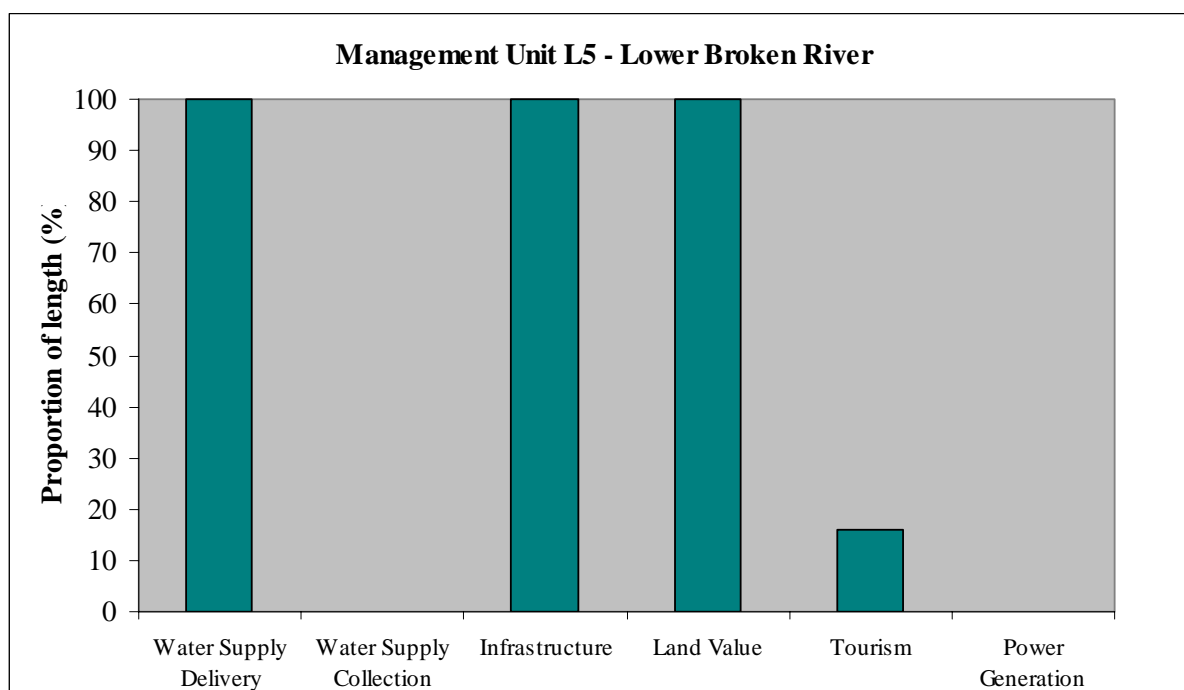


Figure 3.9. Proportion of stream length in Management Unit L5 with Very High or High Economic value rating.

3.2.5 Threats

Stock access is the main physical threat in the Management Unit, noted over all the length (Figure 3.10). Flow deviation is significant over the entire reach. Water quality data is sparse, but at the only sites with data, both water quality values (Table 3.10) and SIGNAL values failed to meet SEPP requirements. The main biological threat in the Management Unit is a permanent fish barrier in the mid part of the Management Unit. There is no data on exotic fauna.

Table 3.10. Attainment of SEPP objectives for 6 water quality parameters in Management Unit L5 VWQMN sites. X - not attained, ✓ - attained, blank – insufficient data.

VWQMN Site code	Location	Nitrogen	Phosphorous	DO	pH	Turbidity	EC
404216	Broken River at Goorambat	X	X	X	✓	X	✓
404224	Broken River at Gowangardie	X	X	X	✓	X	✓

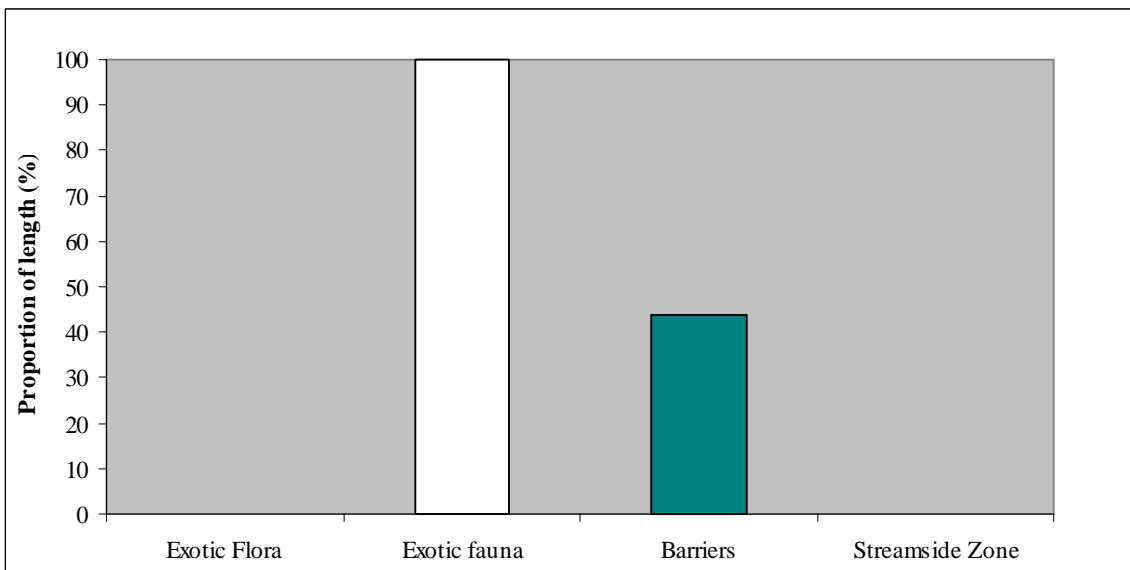
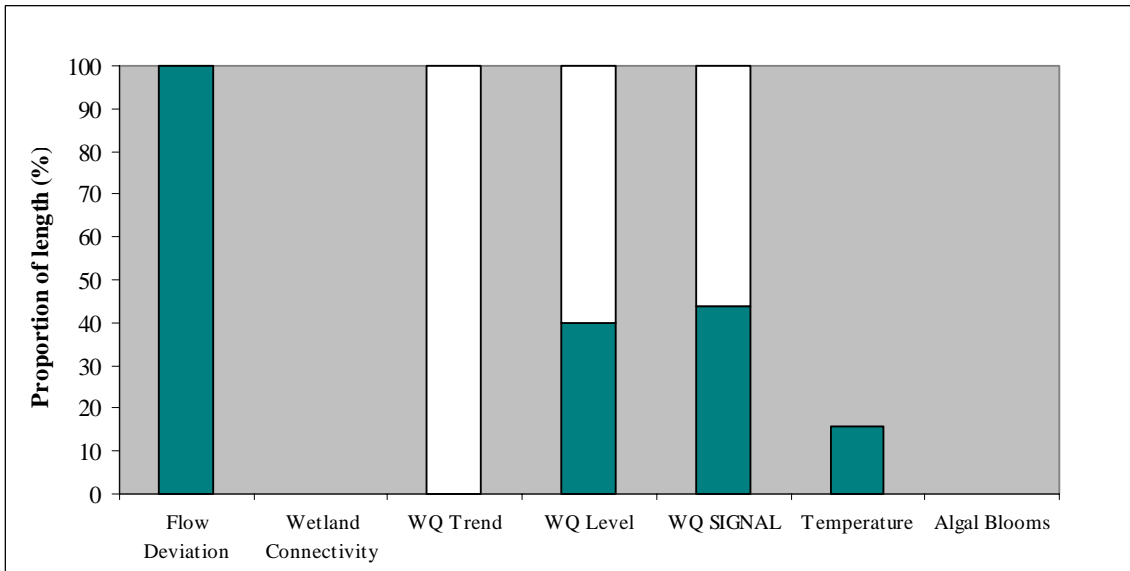
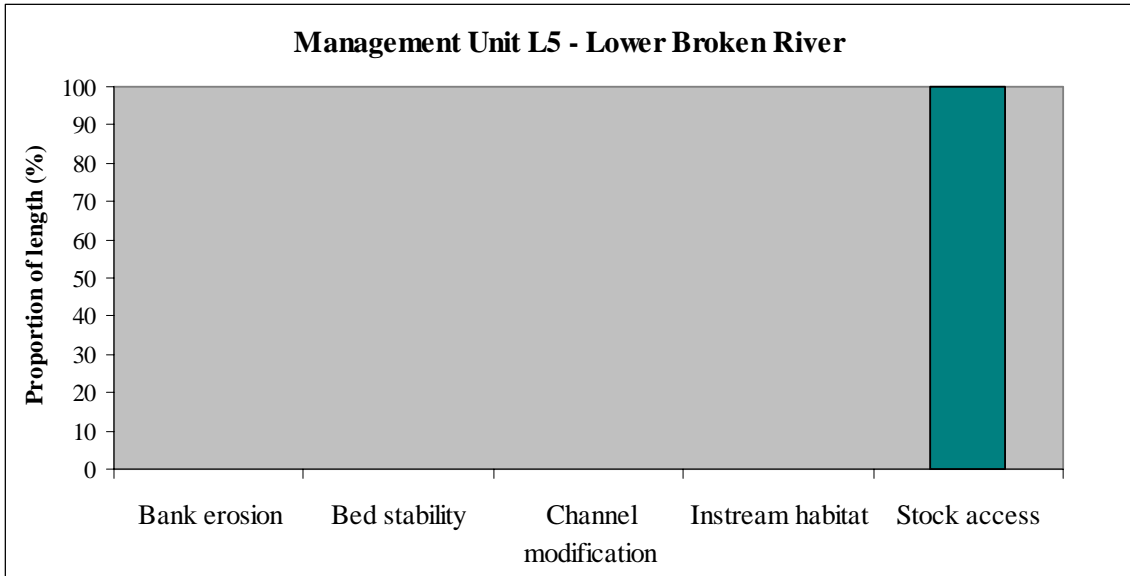


Figure 3.10. Proportion of stream length in Management Unit L5 with Very High or High Threat ratings for Physical (top), Flow and Chemical (middle) and Biological (bottom) components. Blank – No data.

3.3 Management Unit M1 – Mid Broken River

Management Unit M1 – Mid Broken River – covers the Broken River from Casey’s Weir to Lake Nillahcootie. The total length of stream in the Management Unit is 55 km. Three reaches have been identified in the Management Unit, including one urban reach not considered by the ISC.

3.3.1 Summary of Management Unit Values and Threats

The summary table for Environmental, Social and Economic values, and threat ratings for Management Unit M1 (Table 3.11) shows an overall rating for the Management Unit, based on a proportional (by reach length) average of all indices for each component from the RiVERS database.

The Index of Stream Condition scores for each ISC sub-index (Hydrology, Physical Form, Streamside Zone, Water Quality and Aquatic Life) for each reach in the Management Unit is shown in Table 3.12. Where no value for a sub-index is given, there is insufficient data to evaluate that sub-index.

Table 3.11. Summary Table for Environmental, Social and Economic values, and for threat ratings for Management Unit M1.

Environmental	Social	Economic	Threat
Low	Moderate	High	High

Table 3.12. Index of Stream Condition Scores for reaches in Management Unit M1.

Reach	Stream Name	Hydrology	Physical Form	Streamside Zone	Water Quality	Aquatic Life
3	Broken River	0	5	7	7	9
4	Broken River	0	6	6	7	
	Average	0.0	5.5	6.5	7.0	9.0



Broken River (Reach 4)

3.3.2 Environmental values

Rarity

High environmental rarity values in the Management Unit are recorded for significant fauna and for significant EVC (Figure 3.11, Table 3.13)

There are no representative rivers listed in the Management Unit.

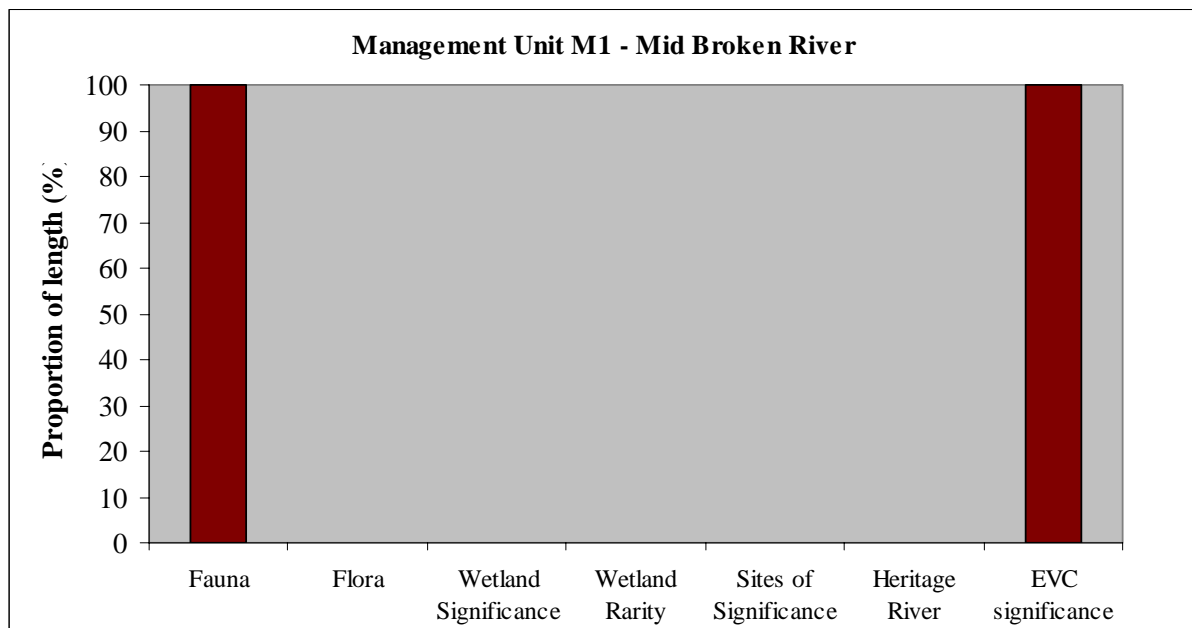


Figure 3.11. Proportion of stream length in Management Unit M1 with Very High or High Environmental Rarity rating.

Table 3.13. Significant fauna, flora and EVC in Management Unit M1.

Fauna	
<ul style="list-style-type: none"> • Bluenose(Trout) cod • Golden perch • Great egret • Macquarie perch 	<ul style="list-style-type: none"> • Mountain galaxias • Nankeen night heron • Regent honeyeater • Royal spoonbill
Flora	
EVC	
<ul style="list-style-type: none"> • Box Ironbark Forest • Floodplain Riparian Woodland • Floodplain Riparian Woodland 	<ul style="list-style-type: none"> • Grassy Dry Forest • Plains Grassy Woodland • Valley Grassy Forest

Naturalness

None of the three reaches show consistent riparian vegetation values. In two short reaches, riparian width is Good, but continuity is low, while in the other reach, continuity is Good, but width is low (Figure 3.12). Invertebrate data is restricted to only one site, where Good community characters were found. Similarly, the native fish community is close to expected in only one reach and exotic fish are common throughout.

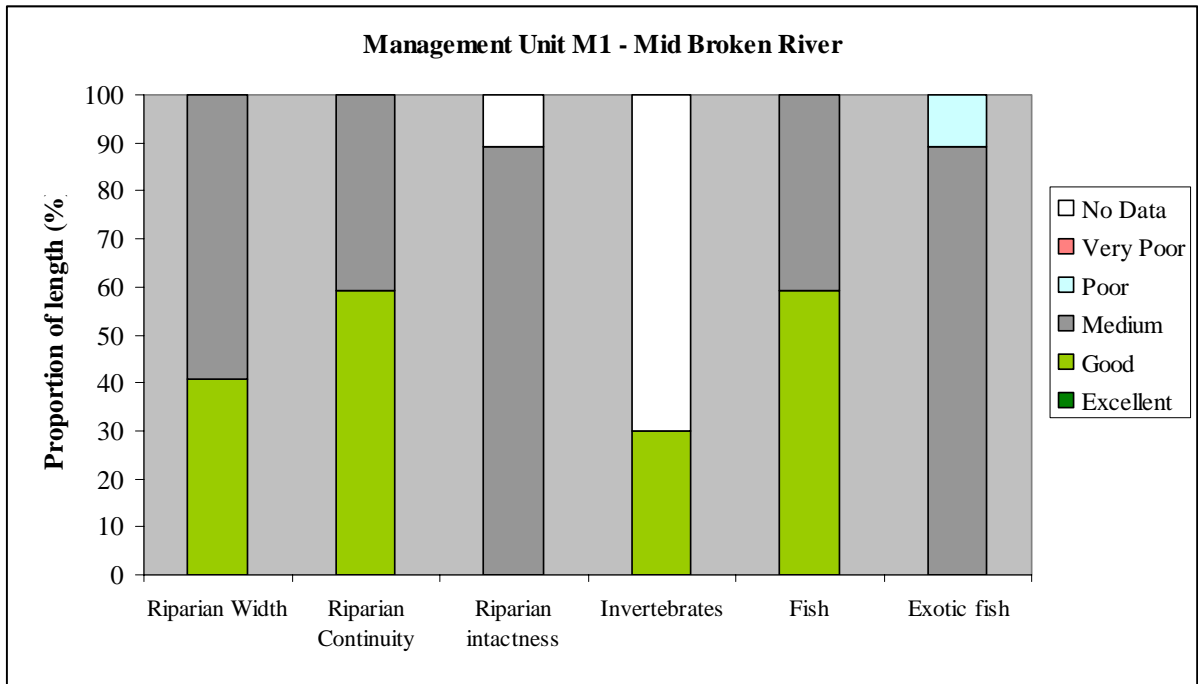


Figure 3.12. Proportion of stream length in Management Unit M1 with various Environmental Naturalness rating.

3.3.3 Social Values

Fishing and species of local significance are the most widespread of the highly rated social values in the Mid Broken River (Figure 3.13, Table 3.14), being found throughout the Management Unit. Swimming and European Heritage values are found over 41% of the reach.

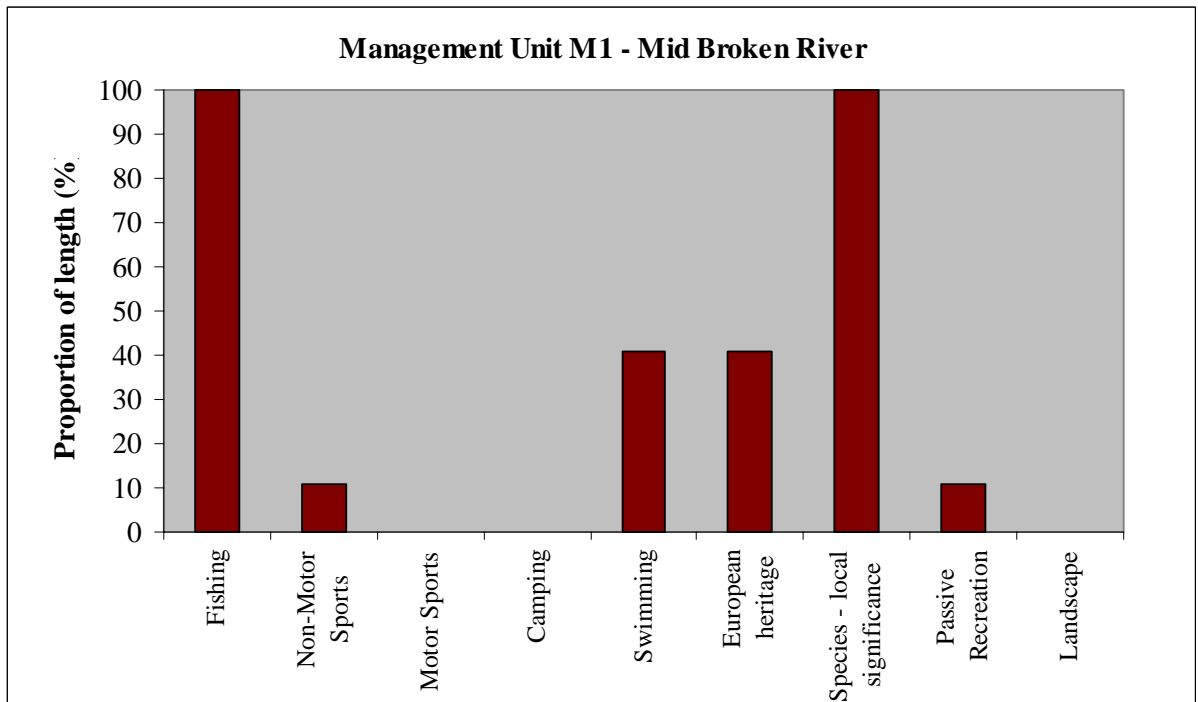


Figure 3.13. Proportion of stream length in Management Unit M1 with Very High or High Social value rating.

Table 3.14. Species of local significance found in Management Unit M1.

Golden perch	Murray crayfish
Macquarie perch	Platypus
Murray cod	

3.3.4 Economic values

Three economic values – Water supply delivery, infrastructure and land value rate highly throughout almost the entire Management Unit (Figure 3.14). Tourism is also a valuable economic asset in the urban section (Benalla).

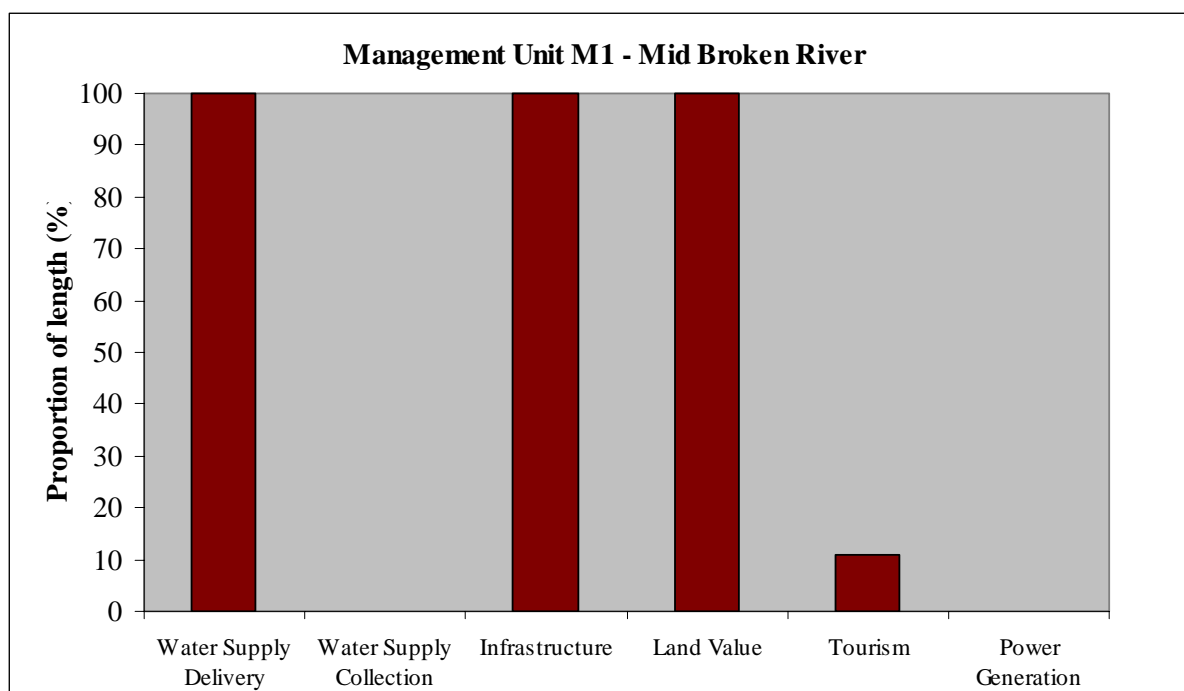


Figure 3.14. Proportion of stream length in Management Unit M1 with Very High or High Economic value rating.

3.3.5 Threats

Stock access and channel modification (de-snagging or realignment) are the main physical threats in the Management Unit, noted over all the length (Figure 3.15). Flow deviation is significant over the entire reach. Where water quality data is available, trend, most water quality values (Table 3.15) and SIGNAL values all fail to meet SEPP requirements. Algal blooms have been found in the lower sections of the Management Unit. The main biological threat in the Management Unit is the permanent downstream fish barrier. There is no data on exotic fauna available.

Table 3.15. Attainment of SEPP objectives for 6 water quality parameters in Management Unit M1 VWQMN sites. ✘ - not attained, ✓ - attained, blank – insufficient data.

VWQMN Site code	Location	Nitrogen	Phosphorous	DO	pH	Turbidity	EC
404206	Broken River at Moorngag	✘	✘	✓	✓	✘	✓

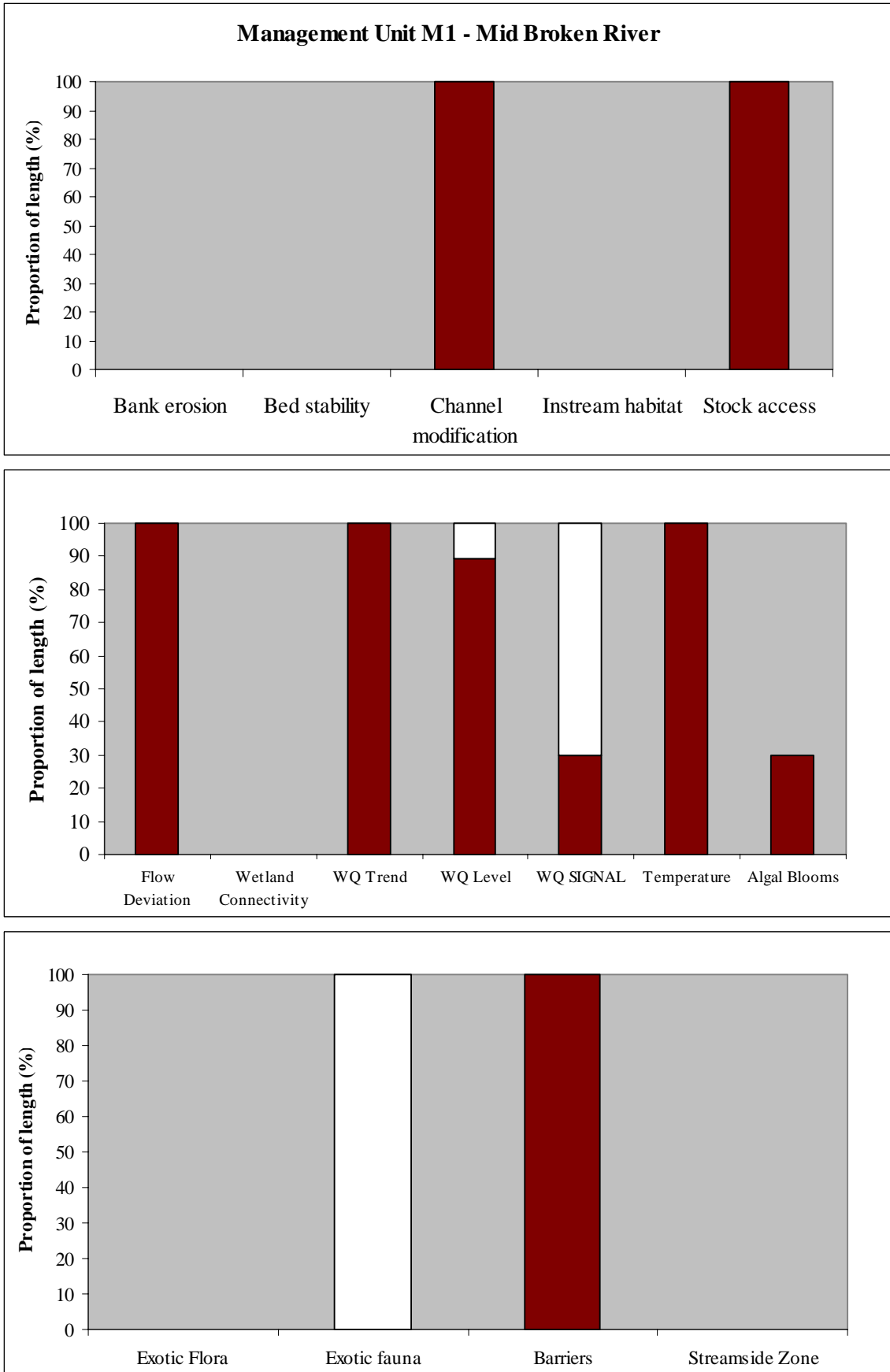


Figure 3.15. Proportion of stream length in Management Unit M1 with Very High or High Threat ratings for Physical (top), Flow and Chemical (middle) and Biological (bottom) components. Blank – No data.

3.4 Management Unit M2 – Upper Broken River catchment

Management Unit M2 – Upper Broken River catchment – consists of the Broken catchment upstream of Lake Nillahcootie, including the Broken River, Halls Weir Creek and Sawpit Creek. The total length of stream in the Management Unit is 52.5 km. Five reaches have been identified in the Management Unit (including one reach for Lake Nillahcootie, not considered under the ISC).

3.4.1 Summary of Management Unit Values and Threats

The summary table for Environmental, Social and Economic values, and threat ratings for Management Unit M2 (Table 3.16) shows an overall rating for the Management Unit, based on a proportional (by reach length) average of all indices for each component from the RiVERS database.

The Index of Stream Condition scores for each ISC sub-index (Hydrology, Physical Form, Streamside Zone, Water Quality and Aquatic Life) for each reach in the Management Unit is shown in Table 3.17. Where no value for a sub-index is given, there is insufficient data to evaluate that sub-index.

Table 3.16. Summary Table for Environmental, Social and Economic values, and for threat ratings for Management Unit M2.

Environmental	Social	Economic	Threat
Low	Moderate	Moderate	Low

Table 3.17. Index of Stream Condition Scores for reaches in Management Unit M2.

Reach	Stream Name	Hydrology	Physical Form	Streamside Zone	Water Quality	Aquatic Life
5	Broken River	10	6	3		9
6	Broken River	10	6	5		
11	Sawpit Creek	6	6	6		
12	Halls Weir Creek	10	6	3		
	Average	9.0	6.0	4.3	n.a.	9.0

3.4.2 Environmental values

Rarity

Rarity values for significant fauna and EVC are high throughout most of the reach (Figure 3.16, Table 3.18). Significant flora and rare wetlands are located in the lower portion of the Management Unit (Lake Nillahcootie and immediately upstream).

There are no representative rivers listed in the Management Unit.

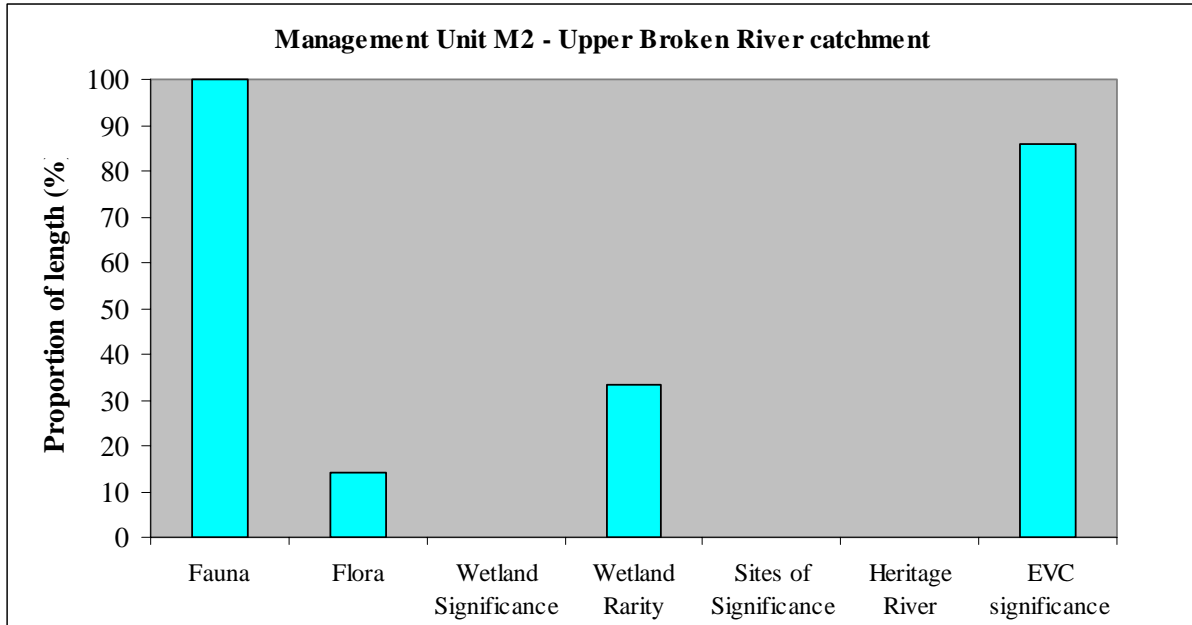


Figure 3.16. Proportion of stream length in Management Unit M2 with Very High or High Environmental Rarity rating.

Table 3.18. Significant fauna, flora and EVC in Management Unit M2.

Fauna	
<ul style="list-style-type: none"> • Australasian shoveler • Bush stone-curlew • Great egret • Hardhead • Macquarie perch • Mountain galaxias 	<ul style="list-style-type: none"> • Murray cod • Musk duck • Pied cormorant • Royal spoonbill • White-bellied sea-Eagle
Flora	
<ul style="list-style-type: none"> • Hypsela 	
EVC	
<ul style="list-style-type: none"> • Creepline Grassy Woodland • Floodplain Riparian Woodland • Grassy Dry Forest • Heathy Dry Forest • Herb-rich Foothill Forest 	<ul style="list-style-type: none"> • Riparian Forest • Riverine Escarpment Scrub • Shrubby Dry Forest • Valley Grassy Forest

Naturalness

Riparian vegetation values are Moderate or less over the entire Management Unit (Figure 3.17). Few data on other naturalness measures are available in the Management Unit. Where invertebrate data have been collected (lower section of the Broken River), SEPP requirements are met. The fish community is close to expected in the lower Broken River section, and exotic fish species are only recorded as uncommon in Lake Nillahcootie.

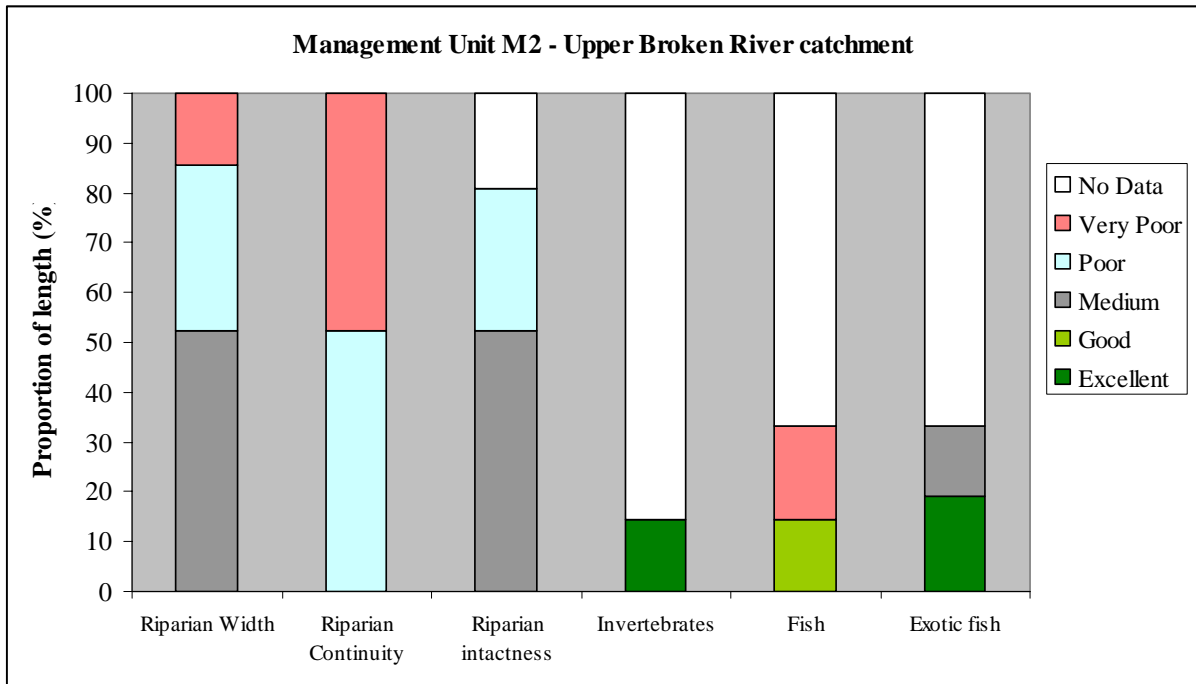


Figure 3.17. Proportion of stream length in Management Unit M2 with various Environmental Naturalness rating.



Broken River (Reach 5)

3.4.3 Social Values

Highly rated social values are generally uncommon in the Upper Broken River catchment Management Unit (Figure 3.18). All high social values are concentrated on Lake Nillahcootie, with only species of local significance found elsewhere in the Management Unit, immediately upstream (Table 3.19)

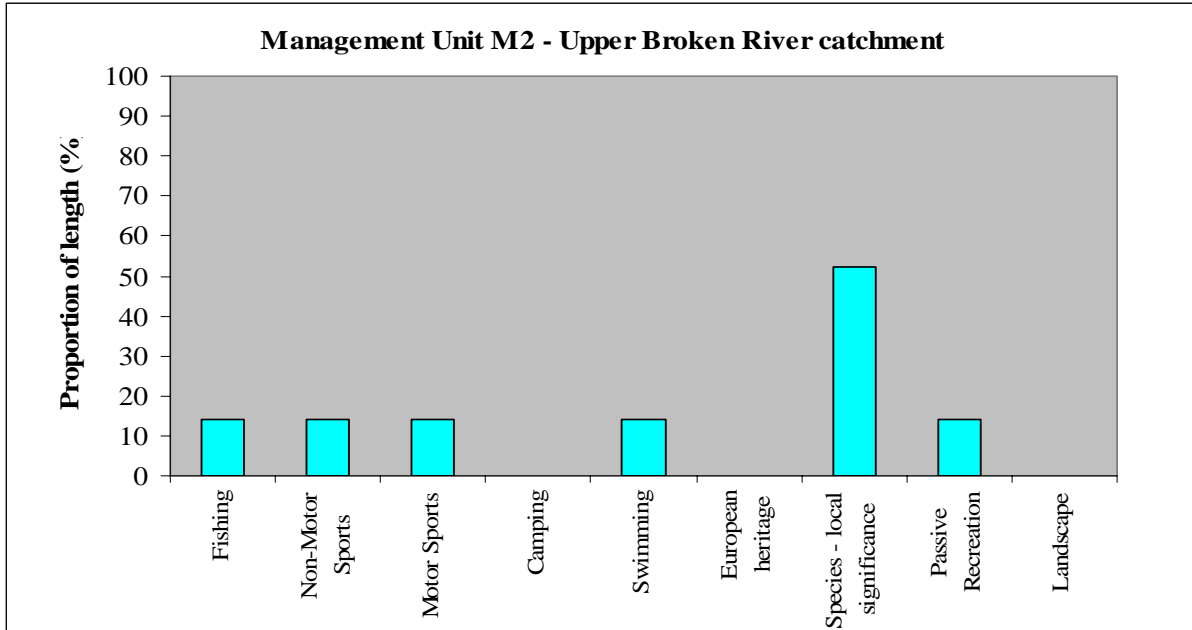


Figure 3.18. Proportion of stream length in Management Unit M2 with Very High or High Social value rating.

Table 3.19. Species of local significance found in Management Unit M2.

Brown trout	Platypus
Macquarie perch	River blackfish

3.4.4 Economic values

Infrastructure is the most widespread high value economic asset in the Management Unit (Figure 3.19). Water supply collection is also high value, recorded over 71% of the length of the Management Unit (the Broken River upstream of Lake Nillahcootie). High value tourism is restricted to Lake Nillahcootie.

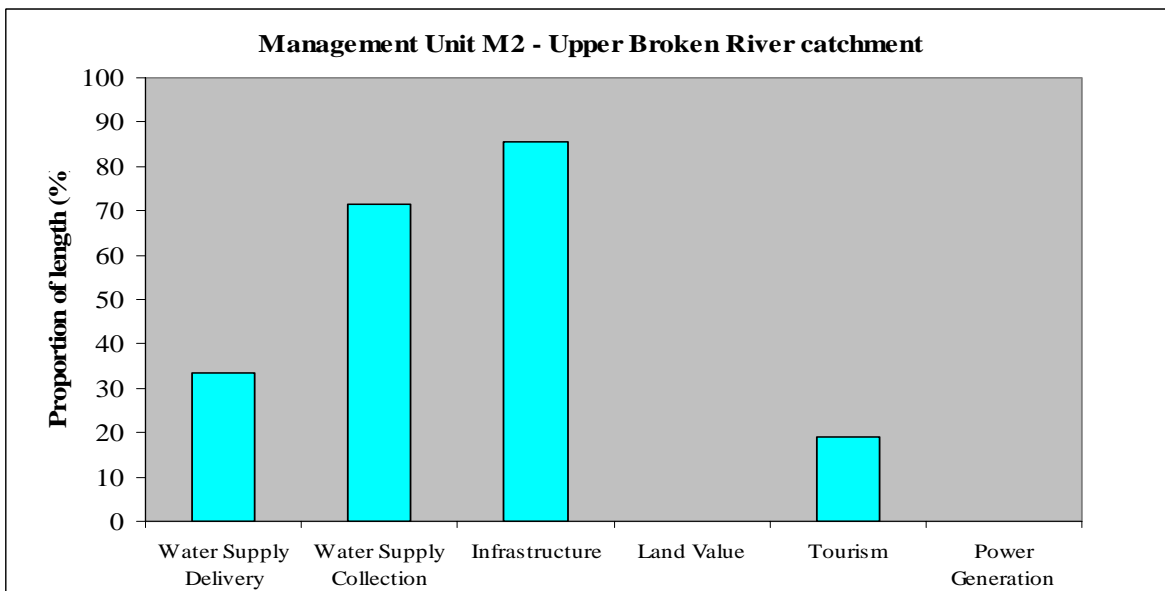
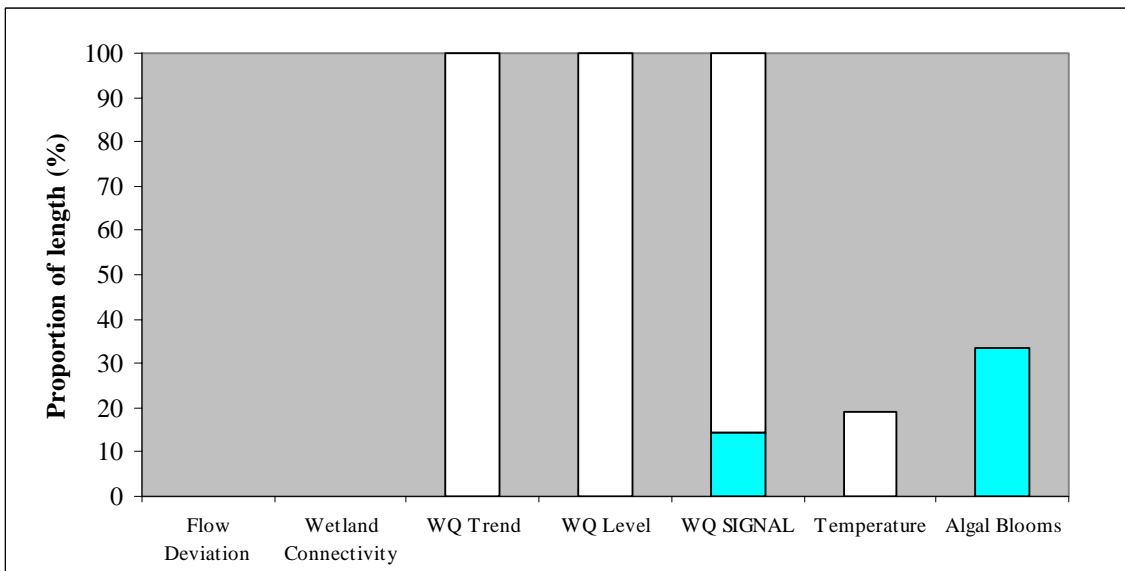
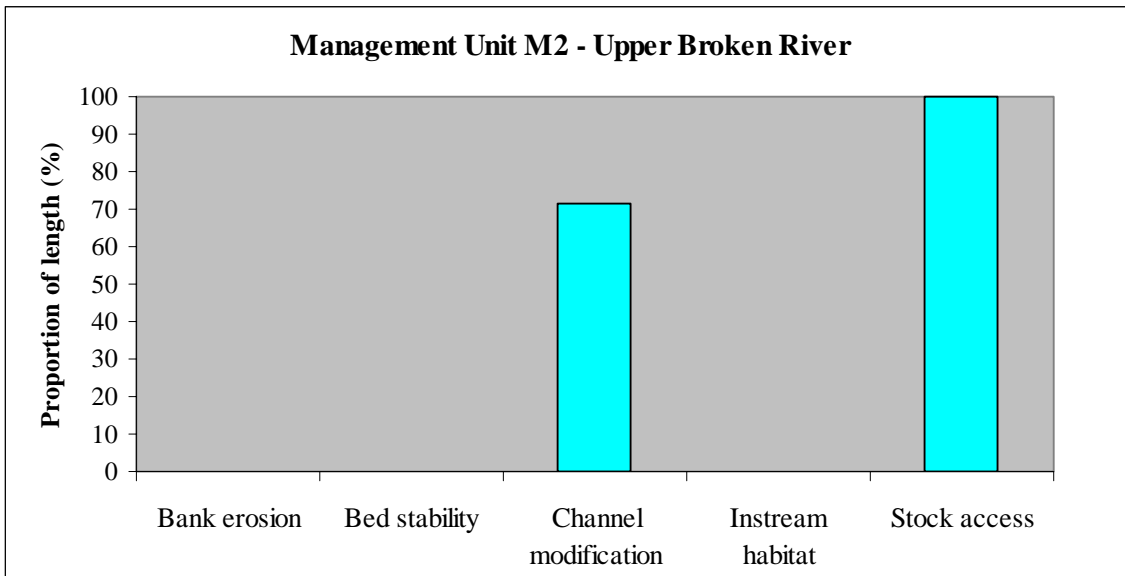


Figure 3.19. Proportion of stream length in Management Unit M2 with Very High or High Economic value rating.

3.4.5 Threats

Stock access is the main physical threat in the Management Unit, noted over all the length (Figure 3.15), with channel modification (de-snagging or realignment) recorded over the Broken River parts of the Management Unit (71% of the length). No significant flow deviation is recorded in the reach. Limited water quality data is available, but where invertebrate data have been collected (lower section of the Broken River), the quality is poor. Algal blooms have been recorded from Lake Nillahcootie.

The main biological threat in the Management Unit is the permanent downstream fish barrier (Lake Nillahcootie, but also barriers further downstream). The streamside zone is also degraded over 48% of the Management Unit. Exotic flora is common in the lower section of the Management Unit, but there is no data on exotic fauna.



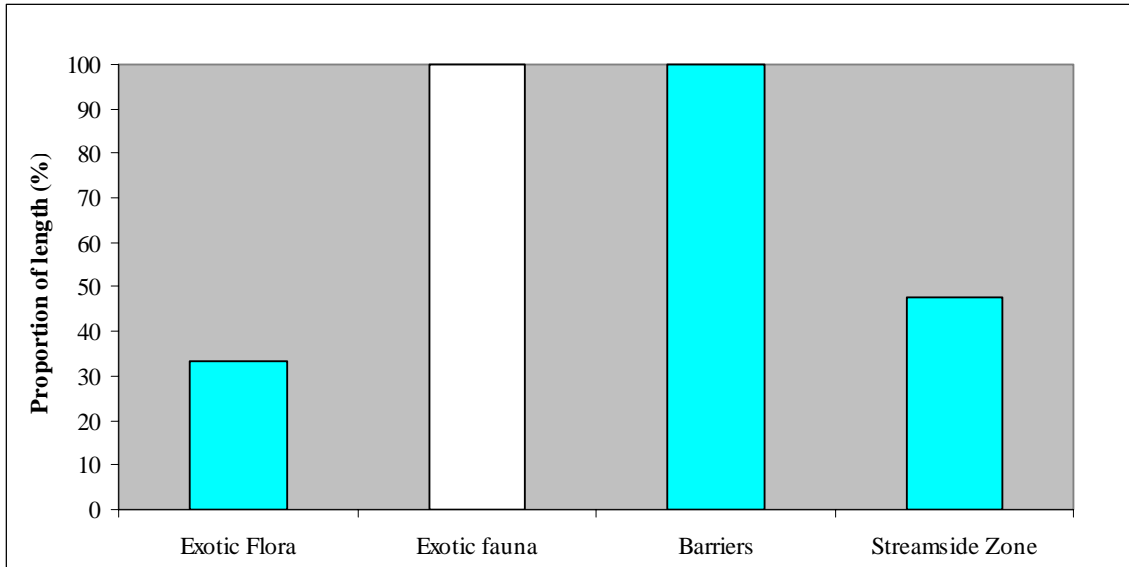


Figure 3.20. Proportion of stream length in Management Unit M2 with Very High or High Threat ratings for Physical (top), Flow and Chemical (middle) and Biological (bottom) components. Blank – No data.



Broken River (Reach 6)

3.5 Management Unit M3 – Ryans and Hollands Creeks

Management Unit M3 – Ryans and Hollands Creeks – comprises the eastern tributaries of the Broken River, including Ryans Creek, Hollands Creek, Sams Creek and Watchbox Creek. The total length of stream in the Management Unit is 127.5 km. Seven reaches have been identified in the Management Unit.

3.5.1 Summary of Management Unit Values and Threats

The summary table for Environmental, Social and Economic values, and threat ratings for Management Unit M3 (Table 3.20) shows an overall rating for the Management Unit, based on a proportional (by reach length) average of all indices for each component from the RiVERS database.

The Index of Stream Condition scores for each ISC sub-index (Hydrology, Physical Form, Streamside Zone, Water Quality and Aquatic Life) for each reach in the Management Unit is shown in Table 3.21. Where no value for a sub-index is given, there is insufficient data to evaluate that sub-index.

Table 3.20. Summary Table for Environmental, Social and Economic values, and for threat ratings for Management Unit M3.

Environmental	Social	Economic	Threat
Moderate	Moderate	Moderate	Low

Table 3.21. Index of Stream Condition Scores for reaches in Management Unit M3.

Reach	Stream Name	Hydrology	Physical Form	Streamside Zone	Water Quality	Aquatic Life
13	Hollands Creek	6	6	6	9	
14	Hollands Creek	10	7	4		9
15	Hollands Creek	10				9
16	Ryans Creek	7	5	5		9
17	Ryans Creek	10	8	8		10
18	Sams Creek	10	5	4		
19	Watchbox Creek	10	4	4		9
	Average	9.0	5.8	5.2	9.0	9.2

3.5.2 Environmental values

Rarity

Significant fauna and EVC are widespread throughout the Management Unit (Figure 3.21, Table 3.22), being located over the entire Management Unit length. Rare wetlands are found over 67% of the Management Unit length. Significant flora species are found in Watchbox Creek and parts of Holland Creek.

A reach of Ryans Creek has been nominated as a Representative River for the North Central Midlands River Region.

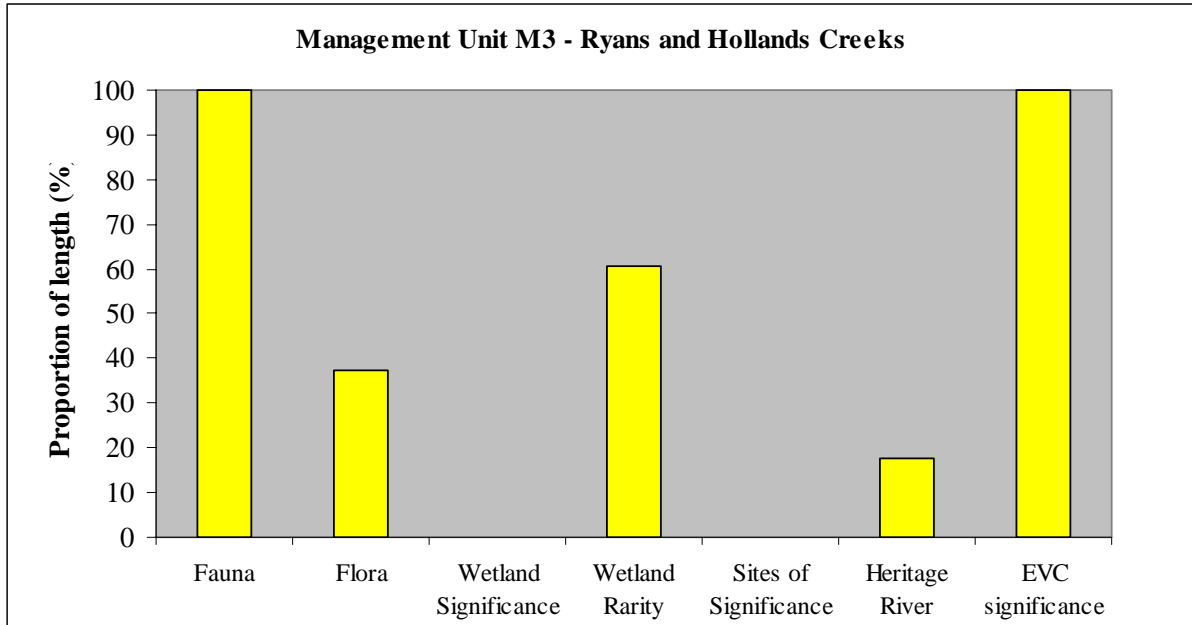


Figure 3.21. Proportion of stream length in Management Unit M3 with Very High or High Environmental Rarity rating.

Table 3.22. Significant fauna, flora and EVC in Management Unit M3.

Fauna	
<ul style="list-style-type: none"> • Bluenose(Trout) cod • Crimson-spotted rainbowfish • Eastern Horseshoe bat • Golden perch 	<ul style="list-style-type: none"> • Macquarie perch • Mountain galaxias • Turquoise parrot
Flora	
<ul style="list-style-type: none"> • Dookie daisy 	
EVC	
<ul style="list-style-type: none"> • Creepline Grassy Woodland • Damp Forest • Floodplain Riparian Woodland • Grassy Dry Forest • Heathy Dry Forest • Herb-rich Foothill Forest • Montane Riparian Thicket • Plains Grassy Woodland 	<ul style="list-style-type: none"> • Riparian Forest • Riparian Forest/Swampy Riparian Woodland/Riparian Shrubland/Riverine Escarpment Scrub/Disturbed Mosaic • Shrubby Dry Forest • Swampy Riparian Woodland • Valley Grassy Forest

Naturalness

Riparian width and continuity is rated Excellent in upper Ryans Creek (Figure 3.22). Little invertebrate data is available (mid Hollands Creek and lower Ryans Creek), but the comparison with the SEPP requirements is poor. The native fish community is as expected or close to it over much of the Management Unit (except for the upper two reaches of Hollands Creek), and exotic fish are common throughout, except in Watchbox Creek.

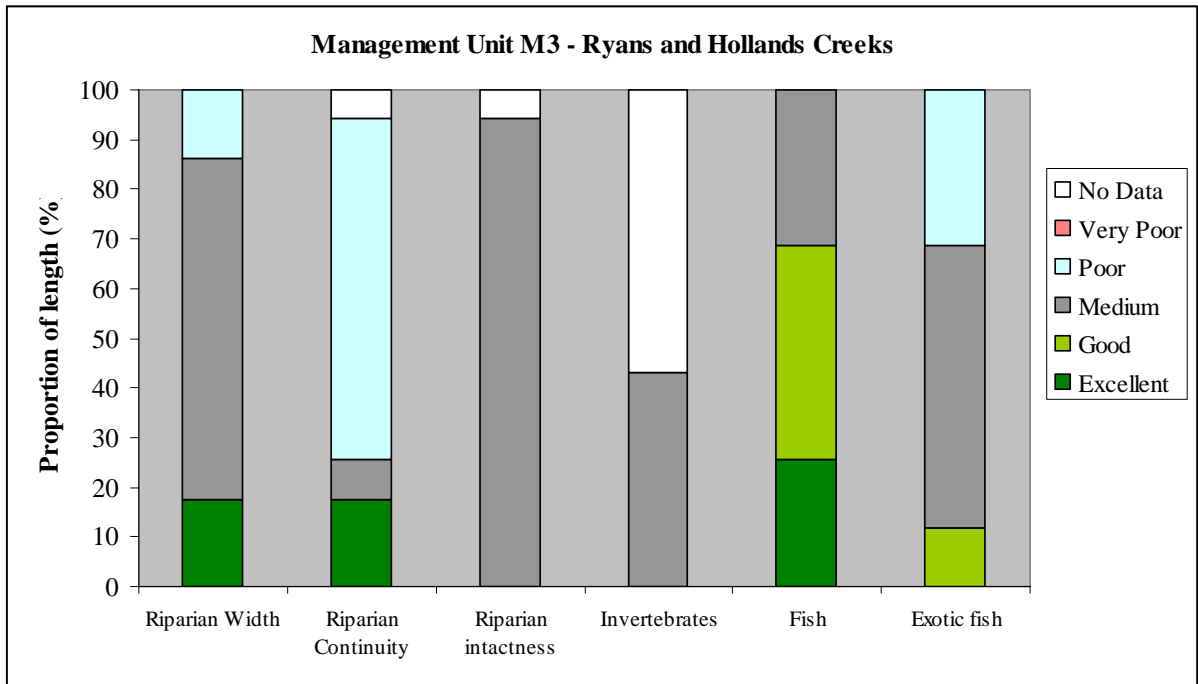


Figure 3.22. Proportion of stream length in Management Unit M3 with various Environmental Naturalness rating.

3.5.3 Social Values

Species of local significance (Table 3.23) are found throughout the Management Unit (Figure 3.23). Other highly rated recreational values (camping, swimming and passive recreation) are less widespread and are concentrated around the lower reaches of Holland Creek.

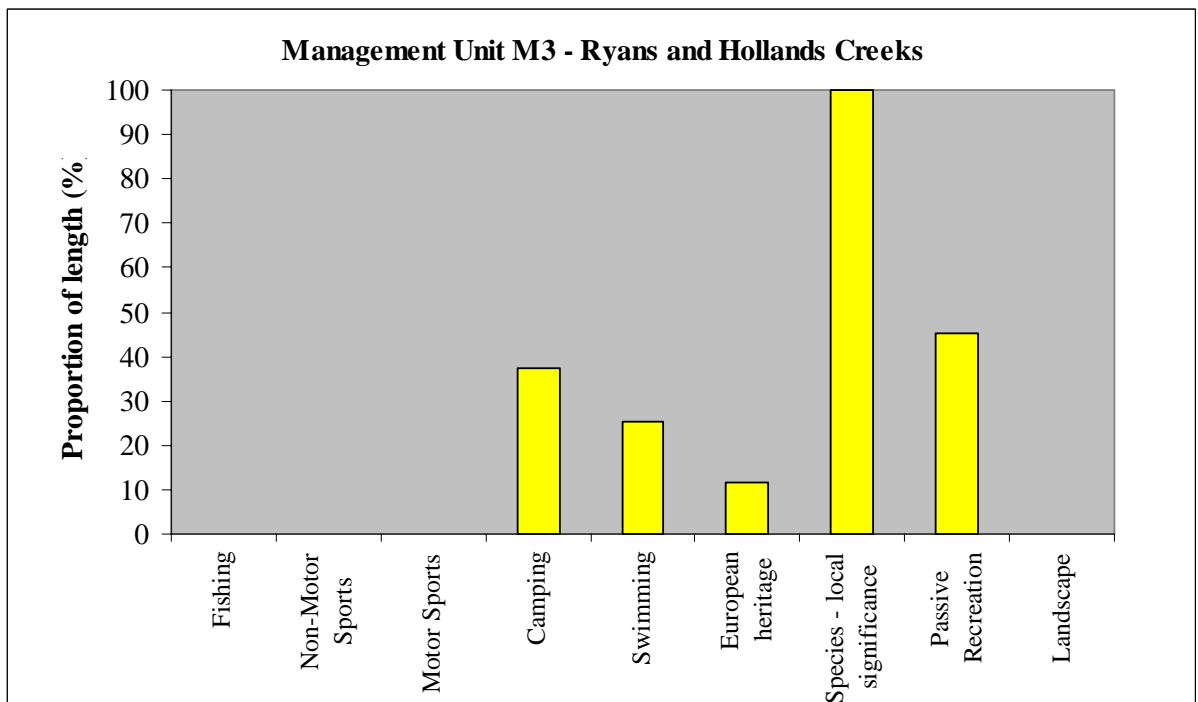


Figure 3.23. Proportion of stream length in Management Unit M3 with Very High or High Social value rating.

Table 3.23. Species of local significance found in Management Unit M3.

Brown trout	Platypus
Golden perch	Rainbow trout
Lyre bird	River blackfish
Macquarie perch	Trout cod
Murray crayfish	



Hollands Creek (Reach 14)

3.5.4 Economic values

Infrastructure is the most widespread high value economic asset in the Management Unit (Figure 3.24), found over 80% of the Management Unit. Tourism is also high value, recorded over 37% of the length of the Management Unit (in Holland and Watchbox Creeks). High and Very High values for water supply delivery and collection are mainly found in the upper reaches of Ryans Creek.

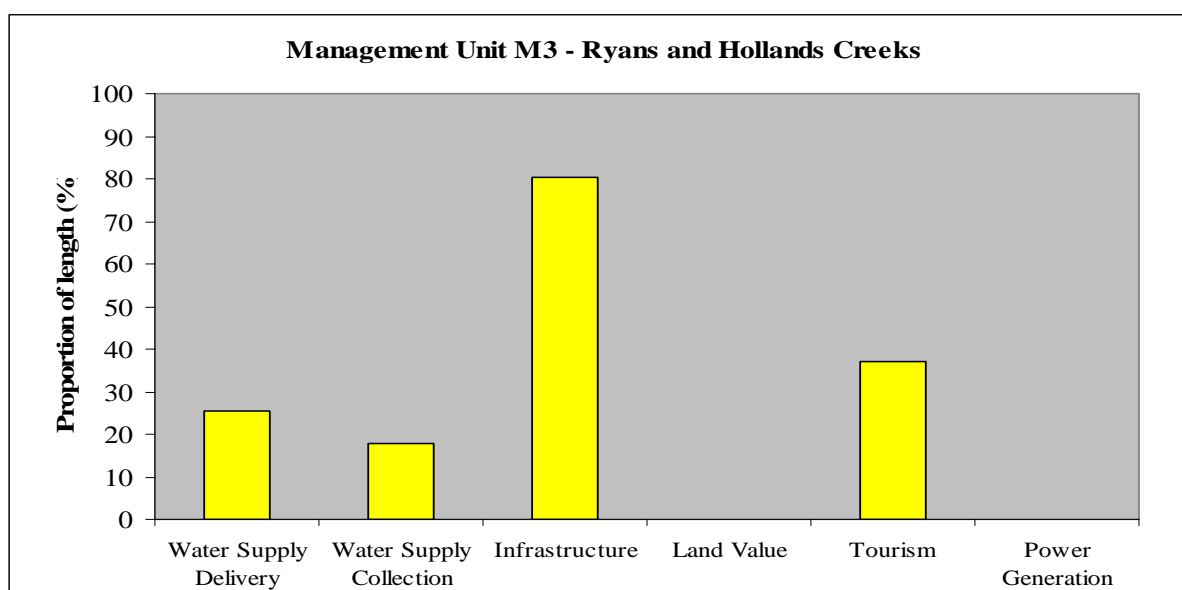
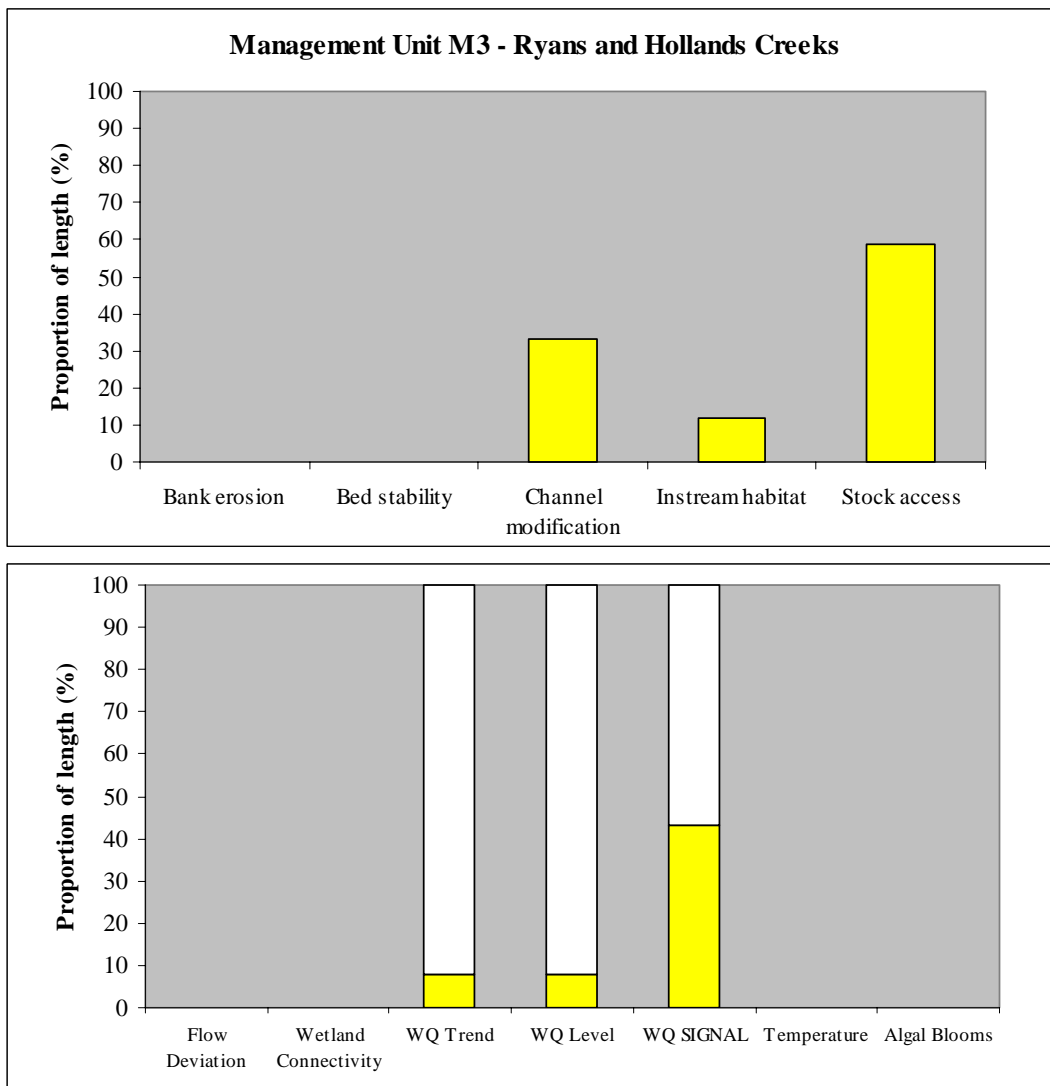


Figure 3.24. Proportion of stream length in Management Unit M3 with Very High or High Economic value rating.

3.5.5 Threats

Stock access is the main physical threat in the Management Unit, noted over 59% of the length (Figure 3.25), with high levels of channel modification (de-snagging or realignment) recorded over the lower Holland Creek (33% of the Management Unit length). No significant flow deviation is recorded in the reach. Little water quality data is available, but where data have been collected (lower section of the Broken River), the quality is poor (Table 3.24). Invertebrate SIGNAL data comparison with the SEPP requirements is poor.

The main biological threat in the Management Unit is the permanent downstream fish barrier which affects the entire Management Unit. The streamside zone is also degraded over 51% of the Management Unit (mid Hollands Creek and the two tributaries – Sam and Watchbox Creeks). Exotic vegetation is common in lower Ryans and Watchbox Creeks, and there is no data on exotic fauna.



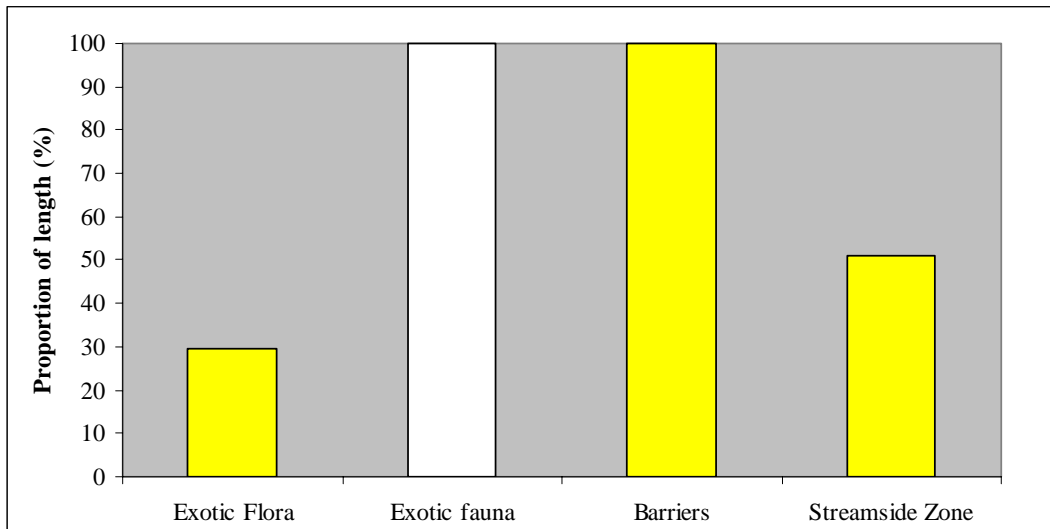


Figure 3.25. Proportion of stream length in Management Unit M3 with Very High or High Threat ratings for Physical (top), Flow and Chemical (middle) and Biological (bottom) components. Blank – No data.

Table 3.24. Attainment of SEPP objectives for 6 water quality parameters in Management Unit M3 VWQMN sites. ✘ - not attained, ✓ - attained, blank – insufficient data.

VWQMN Site code	Location	Nitrogen	Phosphorous	DO	pH	Turbidity	EC
404207	Holland Creek at Kilfeera	✓	✘	✘	✓	✘	✓



**Ryans Creek (Reach 16) –
Loombah Reservoir**

3.6 Management Unit M4 – Lake Mokoan

Management Unit M4 – Lake Mokoan – consists of only a single 17.5 km reach on Winton Creek. This stream is generally considered as representative of the major tributaries entering Lake Mokoan

3.6.1 Summary of Management Unit Values and Threats

The summary table for Environmental, Social and Economic values, and threat ratings for Management Unit M4 (Table 3.25) shows an overall rating for the Management Unit, based on a proportional (by reach length) average of all indices for each component from the RiVERS database.

The Index of Stream Condition scores for each ISC sub-index (Hydrology, Physical Form, Streamside Zone, Water Quality and Aquatic Life) in the single reach in the Management Unit is shown in Table 3.26. Where no value for a sub-index is given, there is insufficient data to evaluate that sub-index.

Table 3.25. Summary Table for Environmental, Social and Economic values, and for threat ratings for Management Unit M4.

Environmental	Social	Economic	Threat
Very Low	Low	Moderate	Low

Table 3.26. Index of Stream Condition Scores for reaches in Management Unit M4.

Reach	Stream Name	Hydrology	Physical Form	Streamside Zone	Water Quality	Aquatic Life
20	Winton Creek	10	3	4		



Winton Creek (Reach 20)

3.6.2 Environmental values

Rarity

High or very high rarity values in the Lake Mokoan Management Unit are present for significant fauna – two bird species - and EVC (Figure 3.26, Table 3.27).

There are no representative rivers listed in the Management Unit.

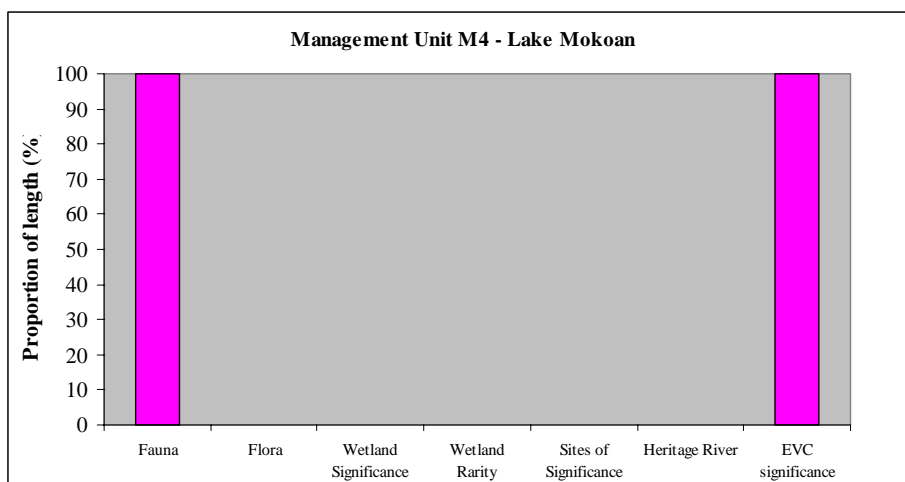


Figure 3.26. Proportion of stream length in Management Unit M4 with Very High or High Environmental Rarity rating.

Table 3.27. Significant fauna, flora and EVC in Management Unit M4.

Fauna	
• Bush Stone-curlew	• Regent Honeyeater
Flora	
EVC	
• Box Ironbark Forest	• Plains Grassy Woodland
• Creekline Grassy Woodland	• Valley Grassy Forest

Naturalness

Riparian vegetation measures are Moderate to Very Poor in the reach (Figure 3.27). No invertebrate or fish data is available for the Management Unit.

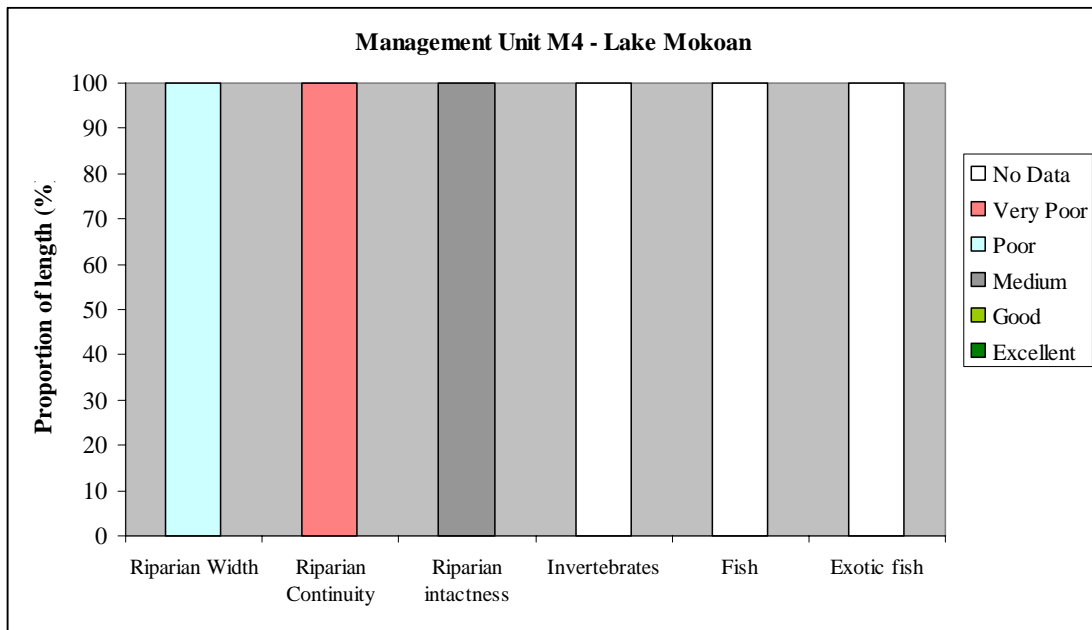


Figure 3.27. Proportion of stream length in Management Unit M4 with various Environmental Naturalness rating.

3.6.3 Social Values

No High or Very Highly rated social values are found in this reach.

3.6.4 Economic values

Infrastructure is the only highly rated economic value in this reach.

3.6.5 Threats

Stock access and poor quality instream habitat are the main physical threats in the reach. No significant flow deviation is noted, and no water quality data is available. The degraded streamside zone and the downstream barrier (Lake Mokoan) are the main biological threats.

3.7 Management Unit M5 – Warrenbayne Creek

Management Unit M5 – Warrenbayne Creek – comprises the western tributaries of the Broken River (Five Mile and Lima East Creeks). The total length of stream in the Management Unit is 63.5 km. Four reaches have been identified in the Management Unit.

3.7.1 Summary of Management Unit Values and Threats

The summary table for Environmental, Social and Economic values, and threat ratings for Management Unit M5 (Table 3.28) shows an overall rating for the Management Unit, based on a proportional (by reach length) average of all indices for each component from the RiVERS database.

The Index of Stream Condition scores for each ISC sub-index (Hydrology, Physical Form, Streamside Zone, Water Quality and Aquatic Life) for each reach in the Management Unit is shown in Table 3.29. Where no value for a sub-index is given, there is insufficient data to evaluate that sub-index.

Table 3.28. Summary Table for Environmental, Social and Economic values, and for threat ratings for Management Unit M5.

Environmental	Social	Economic	Threat
Low	Low	Moderate	Low

Table 3.29. Index of Stream Condition Scores for reaches in Management Unit M5.

Reach	Stream Name	Hydrology	Physical Form	Streamside Zone	Water Quality	Aquatic Life
7	Five Mile Creek	10	4	3		10
8	Five Mile Creek	10				
9	Lima East Creek	2	5	6		10
10	Lima East Creek	6	5	7		
	Average	7.0	4.7	5.3	n.a.	10.0

3.7.2 Environmental values

Rarity

The main High or Very High rarity values in the Warrenbayne Creek Management Unit are for significant fauna and EVC (Figure 3.28, Table 3.30). Rare wetlands are found along 55% of the length of the Management Unit in the lower reaches of Five Mile Creek.

There are no representative rivers listed in the Management Unit.

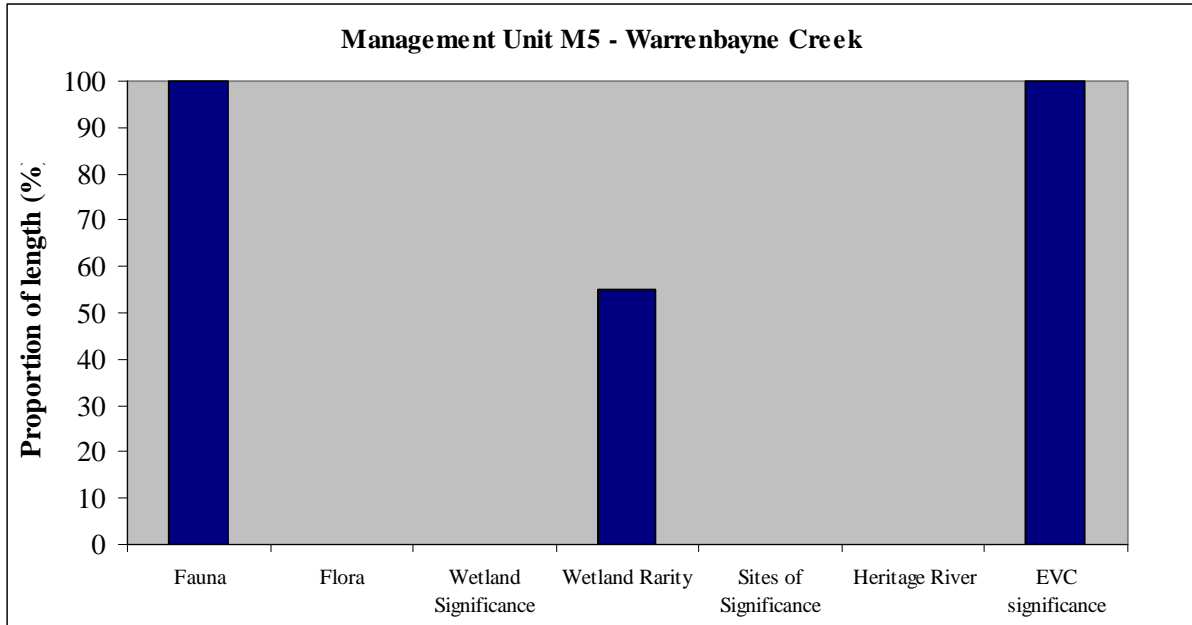


Figure 3.28. Proportion of stream length in Management Unit M5 with Very High or High Environmental Rarity rating.

Table 3.30. Significant fauna, flora and EVC in Management Unit M5.

Fauna	
<ul style="list-style-type: none"> • Bluenose(Trout) cod • Common bent-wing bat 	<ul style="list-style-type: none"> • Flat-headed galaxias • Mountain galaxias
Flora	
EVC	
<ul style="list-style-type: none"> • Creepline Grassy Woodland • Damp Forest • Floodplain Riparian Woodland • Gilgai Plain Woodland/Wetland Mosaic • Grassy Dry Forest • Heathy Dry Forest 	<ul style="list-style-type: none"> • Herb-rich Foothill Forest • Perched Boggy Shrubland Complex • Plains Grassy Woodland • Riparian Forest • Swampy Riparian Woodland • Valley Grassy Forest



Lima East Creek (Reach 9)

Naturalness

All riparian measures are rated Good or Excellent in Lima East Creek (Figure 3.29). Macroinvertebrate and fish communities are at or close to expected in lower Five Mile Creek, but exotic fish are a major component of the fish fauna where there is data (in Five Mile Creek).

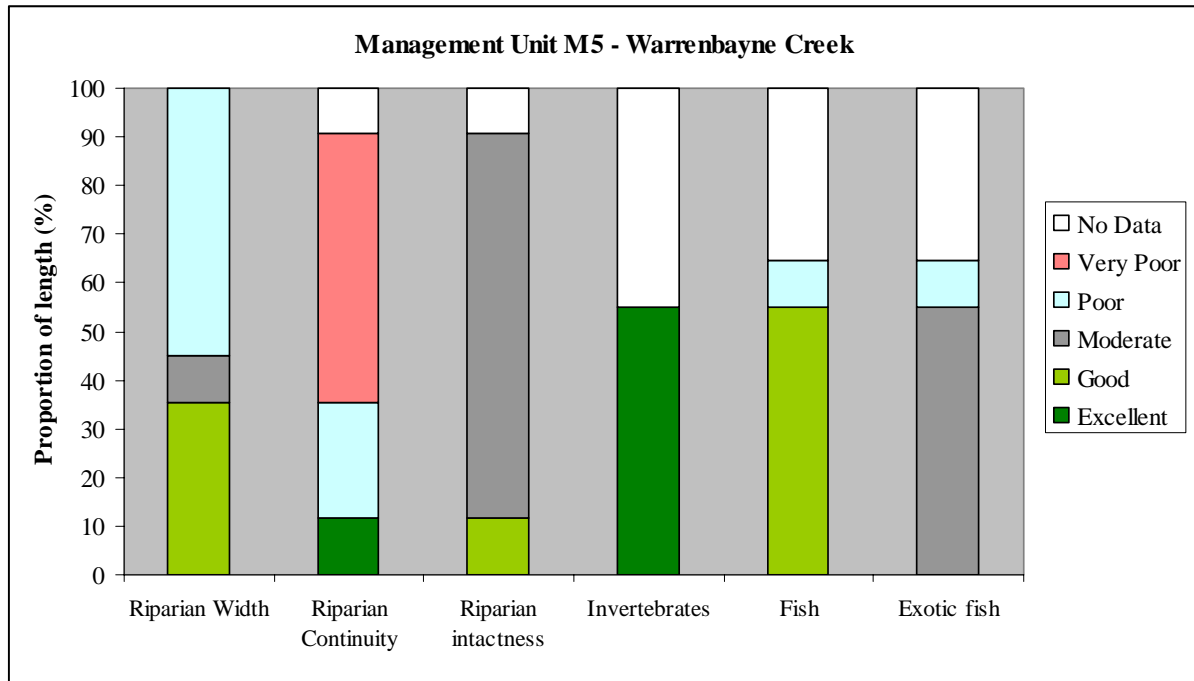


Figure 3.29. Proportion of stream length in Management Unit M5 with various Environmental Naturalness rating.

3.7.3 Social Values

Five species of fish, one invertebrate and Platypus are species of local significance found along the entire length of the Management Unit (Figure 3.30, Table 3.31). Lima East Creek is the only highly rated reach for passive recreation and non-motor sports.

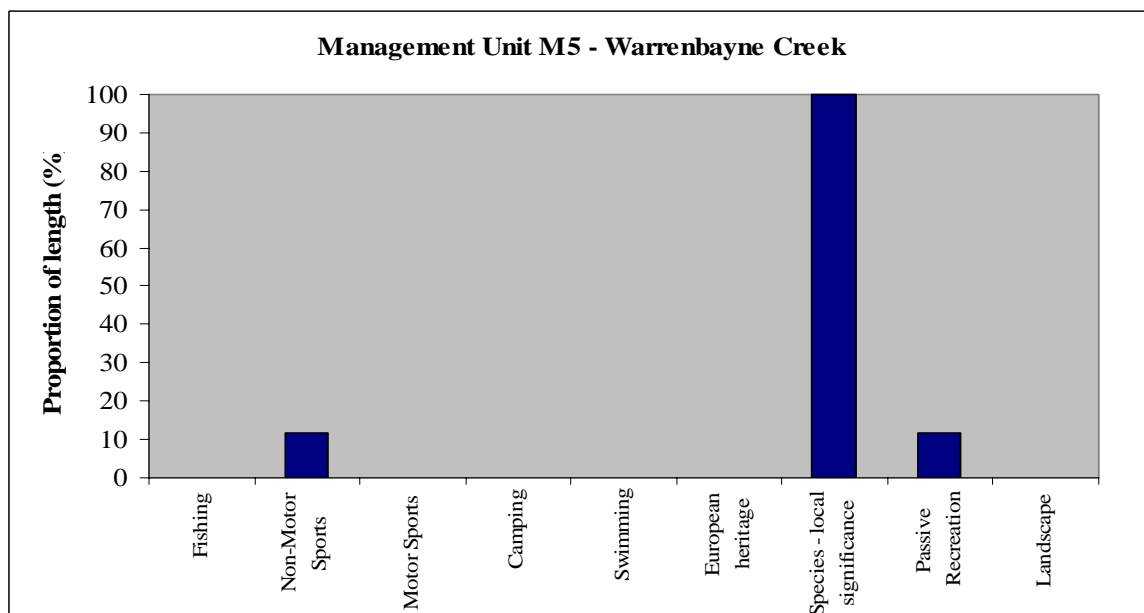


Figure 3.30. Proportion of stream length in Management Unit M5 with Very High or High Social value rating.

Table 3.31. Species of local significance found in Management Unit M5.

Brown trout	Platypus
Golden perch	Rainbow trout
Macquarie perch	River blackfish (Blackfish)
Murray crayfish	

3.7.4 Economic values

Infrastructure is the most widespread high or very high economic value in this Management Unit (Figure 3.31). High value land use is found in the lower Lima East Creek (24% of the length), with high value tourism in the upper parts of the Management Unit.

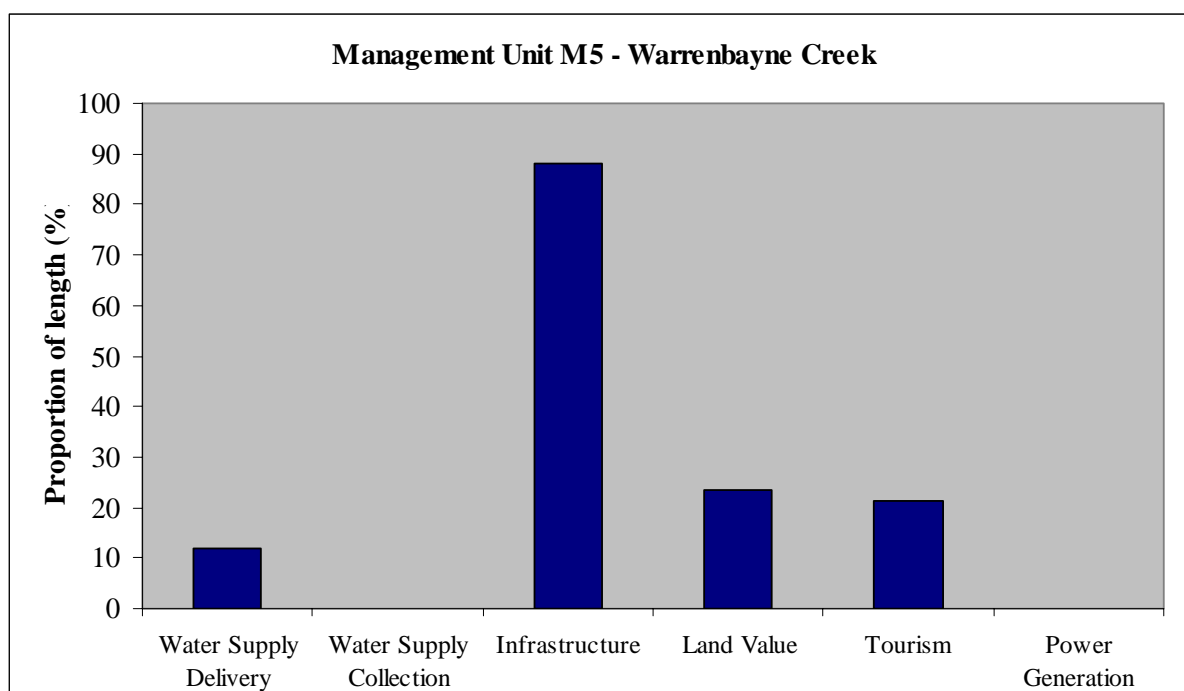


Figure 3.31. Proportion of stream length in Management Unit M5 with Very High or High Economic value rating.

3.7.5 Threats

Stock access and poor quality instream habitat are the main physical threats in the reach (Figure 3.32). Significant flow deviation is noted in upper Five Mile and Lower Lima East Creeks, and limited water quality data is available. Where macroinvertebrate SIGNAL data is present, they indicate no threat to the community from water quality. The degraded streamside zone in lower Five Mile Creek and the downstream barrier are the main biological threats.

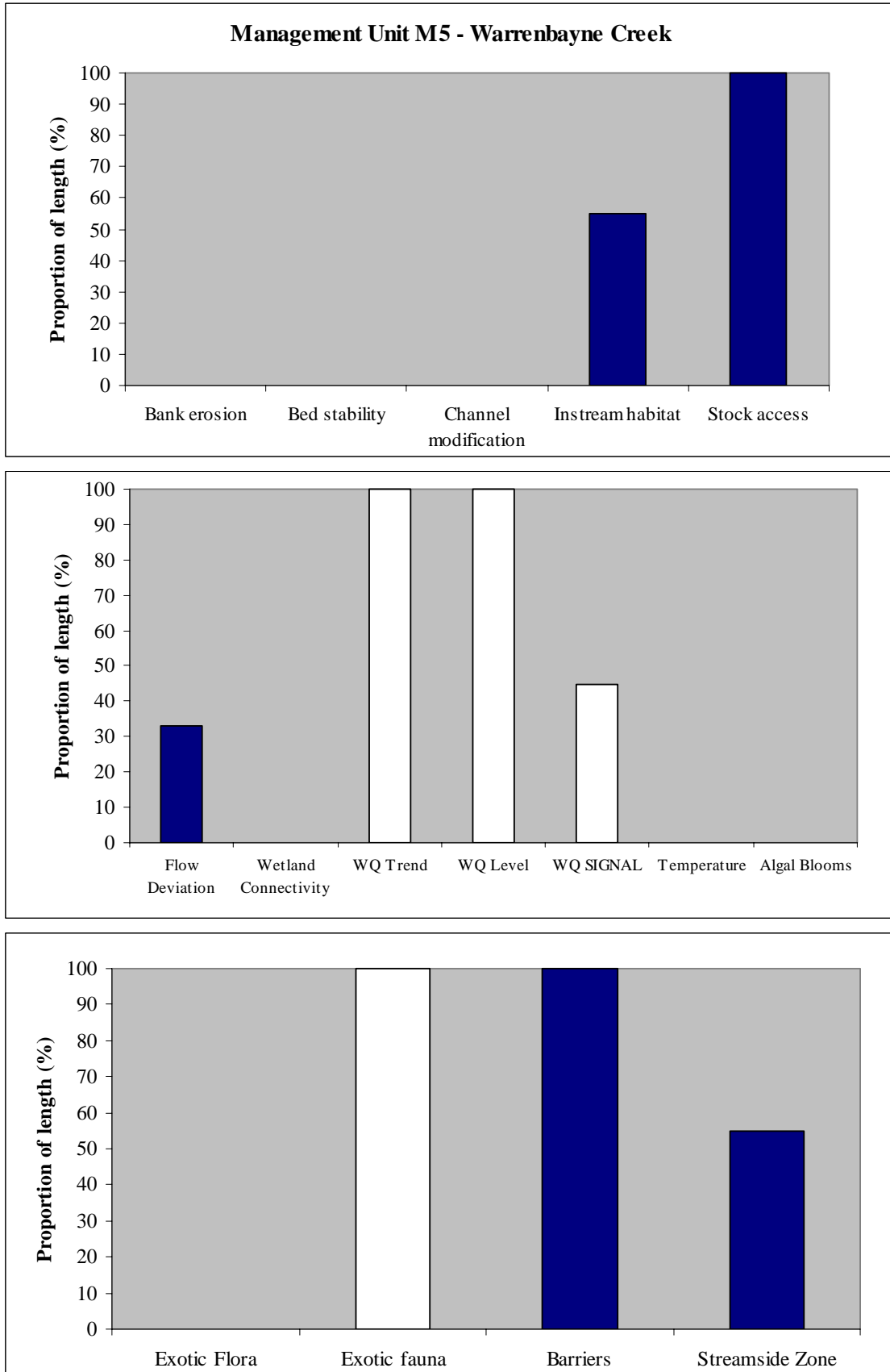


Figure 3.32. Proportion of stream length in Management Unit M5 with Very High or High Threat ratings for Physical (top), Flow and Chemical (middle) and Biological (bottom) components. Blank – No data.

3.8 Management Unit M6 – Upper Broken and Boosey Creeks

Management Unit M6 – Upper Broken and Boosey Creeks – covers the upper catchment of Broken Creek, taking in all of the Boosey Creek subcatchment, and the upper reach in Nine Mile Creek. The total length of stream in the Management Unit is 200 km. Eight reaches have been identified in the Management Unit.

3.8.1 Summary of Management Unit Values and Threats

The summary table for Environmental, Social and Economic values, and threat ratings for Management Unit M6 (Table 3.32) shows an overall rating for the Management Unit, based on a proportional (by reach length) average of all indices for each component from the RiVERS database.

The Index of Stream Condition scores for each ISC sub-index (Hydrology, Physical Form, Streamside Zone, Water Quality and Aquatic Life) for each reach in the Management Unit is shown in Table 3.33. Where no value for a sub-index is given, there is insufficient data to evaluate that sub-index.

Table 3.32. Summary Table for Environmental, Social and Economic values, and for threat ratings for Management Unit M6.

Environmental	Social	Economic	Threat
Low	Low	Moderate	Low

Table 3.33. Index of Stream Condition Scores for reaches in Management Unit M6.

Reach	Stream Name	Hydrology	Physical Form	Streamside Zone	Water Quality	Aquatic Life
25	Broken Creek	2	5	5		
26	Broken Creek	2	4	5		9
27	Broken Creek	2	6	5		
29	Nine Mile Creek	10	5	4		
32	Boosey Creek	6	4	5		9
33	Boosey Creek	6	4	5		8
34	Boosey Creek	2	5	3		
35	Sandy Creek	10	5	5		6
36	Unknown	10				
	Average	5.6	4.8	4.6	n.a.	8.0

3.8.2 Environmental values

Rarity

Significant EVC (Table 3.34) are found throughout the Management Unit, with significant flora (61% of the length) and fauna (46%) comparatively widespread. Significant and rare wetlands are concentrated in the lower sections of Broken Creek.

There are no representative rivers listed in the Management Unit.

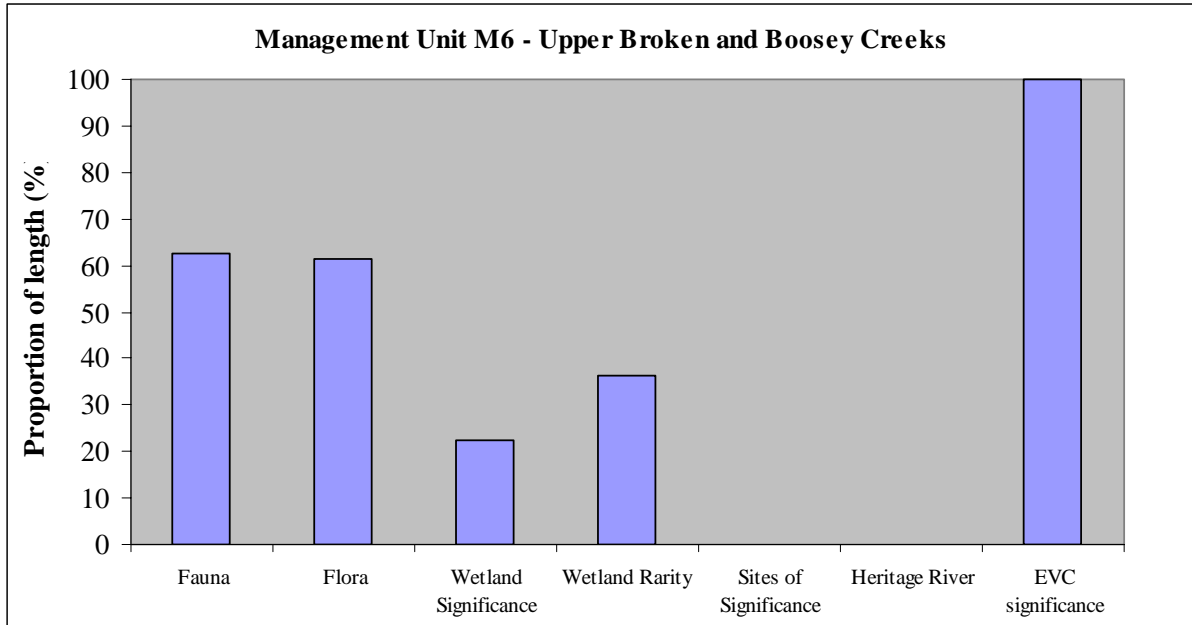


Figure 3.33. Proportion of stream length in Management Unit M6 with Very High or High Environmental Rarity rating.

Table 3.34. Significant fauna, flora and EVC in Management Unit M6.

Fauna	
<ul style="list-style-type: none"> • Australasian shoveler • Black falcon • Brolga • Bush stone-curlew • Great egret 	<ul style="list-style-type: none"> • Mountain galaxias • Nankeen night heron • Red-chested button-quail • Speckled warbler • Warty bell frog
Flora	
<ul style="list-style-type: none"> • Bluish raspwort • Buloke • Common joyweed • Coolibah grass • Forde poa • Leafy templetonia 	<ul style="list-style-type: none"> • Narrow goodenia • Pale spike-sedge • Silky browntop • Slender tick-trefoil • Smooth minuria • Spurred spear-grass
EVC	
<ul style="list-style-type: none"> • Box Ironbark Forest • Creekline Grassy Woodland • Gilgai Plain Woodland/Wetland Mosaic • Granitic Hills Woodland • Grassy Dry Forest • Grassy Woodland • Heathy Dry Forest • Pine Box Woodland/Riverina Plains Grassy Woodland Mosaic 	<ul style="list-style-type: none"> • Plains Grassy Wetland • Plains Grassy Woodland • Plains Grassy Woodland/Gilgai Plains Woodland/Wetland Mosaic • Red Gum Wetland • Red Gum Wetland/Plains Grassy Wetland Mosaic • Spring Soak Woodland • Valley Grassy Forest

Naturalness

Riparian width and continuity are only in Good condition in parts of Boosey Creek (Figure 3.34). Invertebrate condition satisfies SEPP requirements in the lower sections of Broken Creek, but not in mid-Boosey Creek (with no data for the rest). Native fish communities correspond closely to that expected only in lower Boosey Creek, and exotic fish are common throughout.

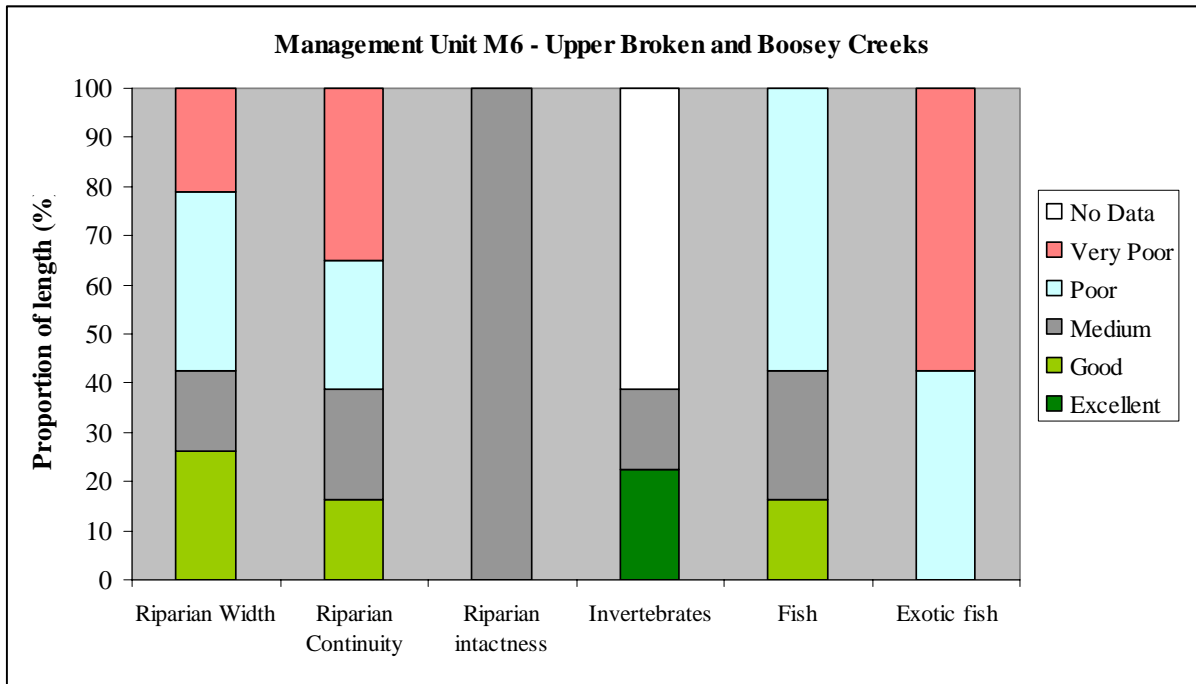


Figure 3.34. Proportion of stream length in Management Unit M6 with various Environmental Naturalness rating.



Broken Creek (Reach 27)

3.8.3 Social Values

Highly rated social values are relatively sparse in the Management Unit (Figure 3.35), with species of local significance the most widespread (71% - Table 3.35). Passive recreation is high value at the lower end of Broken Creek and the upper Boosey Creek. European Heritage sites are located in upper Boosey Creek.

3.8.4 Economic values

High or Very High economic values for infrastructure and water supply delivery are found over much of the Management Unit (Figure 3.36). Tourism is a focus in upper Boosey Creek.

Table 3.35. Species of local significance found in Management Unit M6.

Carpet python	Platypus
Golden perch	River redgum
Murray cod	

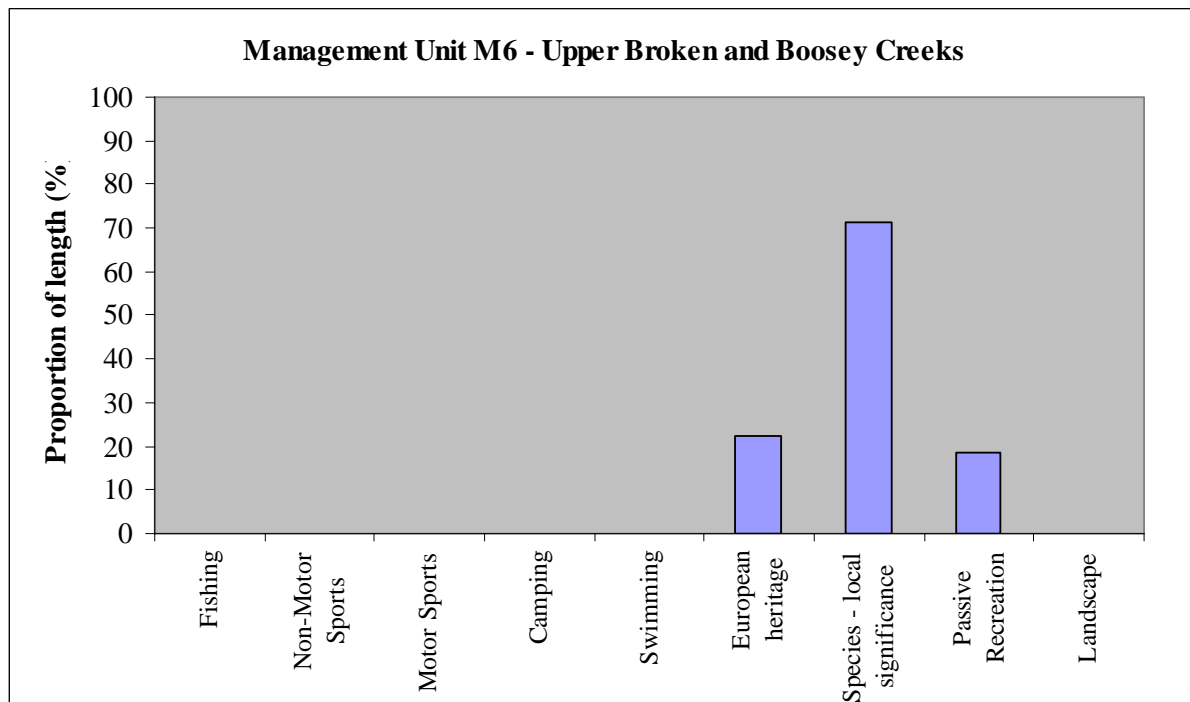


Figure 3.35. Proportion of stream length in Management Unit M6 with Very High or High Social value rating.



Boosey Creek (Reach 34)

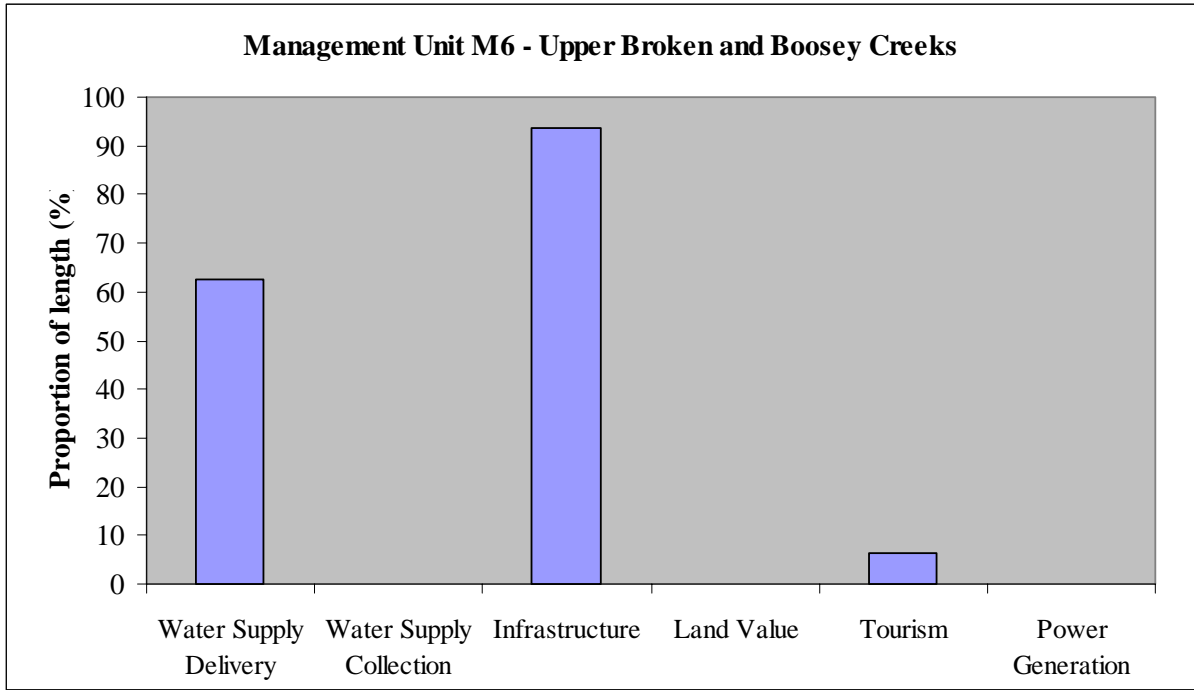
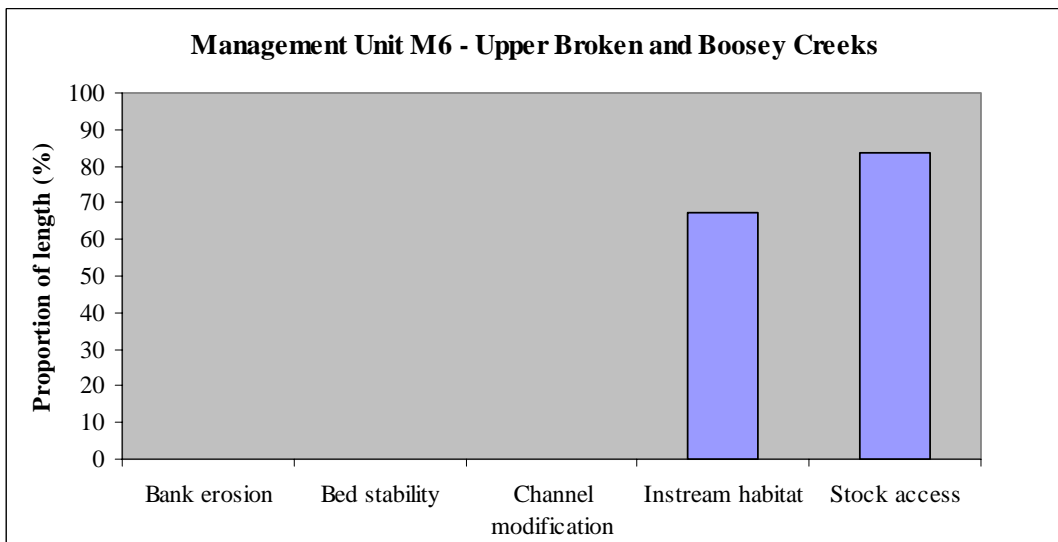


Figure 3.36. Proportion of stream length in Management Unit M6 with Very High or High Economic value rating.

3.8.5 Threats

Stock access and poor quality instream habitat are the main physical threats in the reach (Figure 3.37). Significant flow deviation is noted in Broken Creek and upper Boosey Creek, and some water quality data is available from the Broken Creek. Where data is present, they indicate poor water quality (Table 3.36). Degraded streamside zones in upper Nine Mile and Boosey Creeks, and the downstream barriers in Broken Creek are the main biological threats.



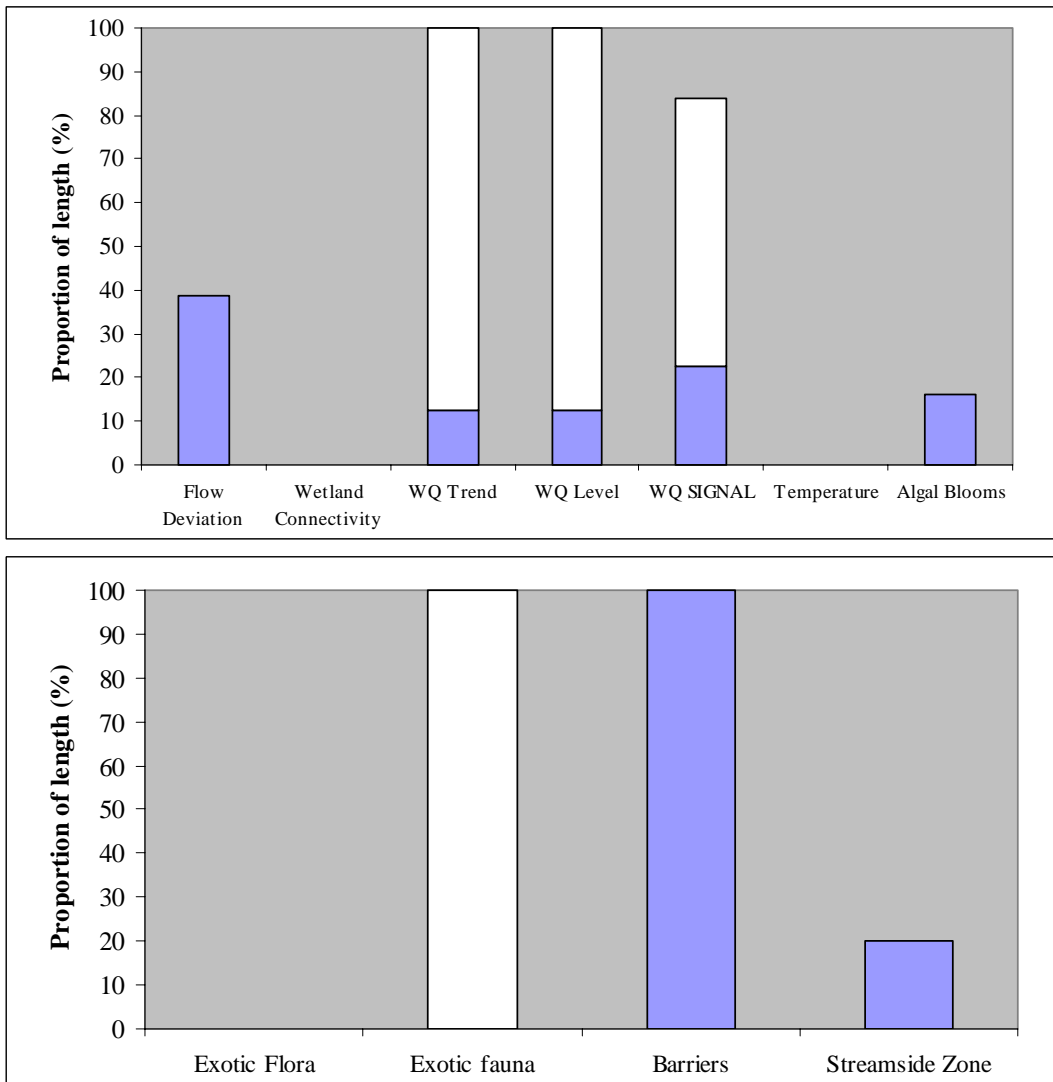


Figure 3.37. Proportion of stream length in Management Unit M6 with Very High or High Threat ratings for Physical (top), Flow and Chemical (middle) and Biological (bottom) components. Blank – No data.

Table 3.36. Attainment of SEPP objectives for 6 water quality parameters in Management Unit M6 VWQMN sites. X - not attained, ✓ - attained, blank – insufficient data.

VWQMN Site code	Location	Nitrogen	Phosphorous	DO	pH	Turbidity	EC
404214	Broken Creek at Katamatite	X	X	X	✓	X	✓

4. References

LCC. (1991). *Rivers and Streams: Special Investigation. Final Recommendations*. Land Conservation Council, Melbourne.

NRE. (2002). *Victorian River Health Strategy - Healthy Rivers, Health Communities and Regional Growth*. Department of Natural Resources and Environment, Melbourne.

Victorian Water Resources Data Warehouse: <http://www.vicwaterdata.net/>