
CATCHMENT ACTION PLAN:

Draft Upper Loddon Catchment Action Plan

April 2008



NORTH CENTRAL
Catchment Management Authority

Document history

REVISION

ISSUE DATE	VERSION NO.	AUTHOR(S)	CHECKED	APPROVED
15 April 08	1	J. Matthew, K. Travis	A. Vlok	K. Travis
23 April 08	2	K. Travis		K. Travis
28 April 2008	3	K. Travis		K. Travis

DISTRIBUTION

VERSION NO.	ISSUED TO	DESCRIPTION
1	Megan Kreutzer	First draft for comment
2	Megan Kreutzer	Second draft for public comment
3	Megan Kreutzer	Modified draft for public comment

CITATION

Please cite this document as

Matthew, J., Vlok, A., and Travis, K (2008) *Upper Loddon Catchment Action Report* by Alluvium and HLA ENSR for North Central Catchment Management Authority (North Central CMA).

ACKNOWLEDGEMENTS

The authors wish to acknowledge the contribution of the North Central CMA (NCCMA) project manager Megan Kreutzer, the Steering Committee, the NCCMA staff who participated in the community forums, representatives from community groups, and the many interested and passionate individuals who attended the community forums in Yandoit, Glenlyon and Daylesford.

Contents

Document history	i
Contents	ii
List of tables	iii
List of figures	iv
Acronyms and Abbreviations	v
1 Introduction	1
2 How this document was developed	3
3 How to use this document	4
4 Alignment with Key Strategies	4
5 Downstream Impacts	4
6 Objectives of this CAP	5
7 Catchment details	6
8 Upper Loddon Catchment – the project area	9
9 Community feedback	18
10 Priorities	20
11 Loddon River (Reach 10) Action Plan	24
12 Loddon River (Reach 48) & Kangaroo Creek (Reach 49) Action Plan	28
13 Jim Crow Creek (Reach 27) Action Plan	32
14 Sailors Creek (Reach 28)	36
15 Monitoring of success	41
16 Gaps in knowledge and further investigation	45
17 Education and training opportunities	47
18 References	48
APPENDIX 1 - Relationship Between CAPs and Other Plans/Strategies	50
APPENDIX 2 – Documents reviewed	52
APPENDIX 3 - Results of field inspection	54
APPENDIX 4 - Financial calculations and assumptions	59

List of tables

Table 1 Summary of North Central waterway condition according to the 1999 ISC results	10
Table 2 Value and threat categories assigned to the RiVERS database	10
Table 3 Summary of risk assessment and assessment against priority principles.	12
Table 4 List of main EVCs present in Upper Loddon Catchment	13
Table 5 List of threatened EVCs with limited distribution in Upper Loddon (above Cairn Curran) Catchment	13
Table 6 Threatened flora species recorded from Viridans (2005) database in Upper Loddon catchment (above Cairn Curran).	14
Table 7 Threatened fauna species recorded from Viridans (2005) database in Upper Loddon (above Cairn Curran) catchment.	16
Table 8 Community issues and incorporation into CAP	18
Table 9 High value areas of the Loddon River (Reach 10)	24
Table 10 Action priorities for the Loddon River (Reach 10)	24
Table 11 Loddon River (Reach 10) Action table	25
Table 12 Action priorities for the Loddon River (Reach 48) and Kangaroo Creek (Reach 49)	28
Table 13 Loddon River (Reach 48) & Kangaroo Creek (Reach 49) Action table	29
Table 14 High value areas of Jim Crow Creek (Reach 27)	32
Table 15 Action priorities for Jim Crow Creek (Reach 27)	32
Table 16 Jim Crow Creek (Reach 27) Action table	33
Table 17 High value areas for Sailor Creek (Reach 28)	36
Table 18 Action priorities for Sailors Creek (Reach 28)	36
Table 19 Sailors Creek (Reach 28) Action Table	37
Table 20 Revegetation	41
Table 21 Stock exclusion fencing	42
Table 22 Erosion	42
Table 23 Protection of high value areas	43
Table 24 Monitoring Program	44

List of figures

Figure 1- Process for developing this CAP	3
Figure 2 Region of the NCCMA	6
Figure 3 The Loddon River catchment	7
Figure 4 The project area (Upper Loddon catchment) NCCMA, 2005.	9
Figure 5 – Biodiversity Values – Reach 10 (Upper Loddon River)	26
Figure 6 – CAP Actions – Reach 10 (Upper Loddon River)	27
Figure 7 – Biodiversity Values – Reach 48 (Kangaroo Creek) & Reach 49 (Upper Loddon River)	30
Figure 8 – CAP Actions – Reach 48 (Kangaroo Creek) & Reach 49 (Upper Loddon River)	31
Figure 9 – Biodiversity Values – Reach 27 (Jim Crow Creek)	34
Figure 10 – CAP Actions – Reach 27 (Jim Crow Creek)	35
Figure 11 – Biodiversity Values – Reach 28 (Sailors Creek)	39
Figure 12 – CAP Actions – Reach 28 (Sailors Creek)	40

Acronyms and Abbreviations

AUSRIVAS	Australian River Assessment System
CMA	Catchment Management Authority
CAP	Catchment Action Plan
DNRE	Department of Natural Resources and Environment
DPI	Department of Primary Industries
DSE	Department of Sustainability and Environment (formerly DNRE)
EPA	Environment Protection Agency
EVC	Ecological Vegetation Class
FFG Act	<i>Flora and Fauna Guarantee Act 1988</i>
ISC	Index of Stream Condition
ML	Mega litre
NCCMA	North Central Catchment Management Authority
RCS	Regional Catchment Strategy
RiVERS	River Values & Environmental Risk System
RHS	River Health Strategy
VRHS	Victorian River Health Strategy

1 Introduction

Rivers and waterways make up only a small portion of the Victorian landscape and yet their overall significance for the economy, ecology and social fabric of Victoria is immense. Historically, most towns in Victoria were situated near a river to provide a source of water and transport and consequently Victoria's rivers have become entwined into the lives and histories of people.

Rivers provide a space for recreation, tourism and community meeting places. They support a large array of native flora and fauna (many of which are threatened or endangered), and are highly important in the transporting and cycling of sediment and nutrients through the landscape.

Virtually all of these values are reliant to some extent on (good) river condition. Waterway health is affected by many factors including declining water quality, salinity, modified flow regimes, loss of riparian vegetation, poor land management practices, climate change and fragmentation of floodplains and wetlands. Currently, only 22% of Victoria's major rivers and streams could be classified as either in good or excellent condition and unfortunately many are continuing to decline (DNRE, 2002a).

In response to this challenge the Victorian Government released the Victorian River Health Strategy (VRHS) which was followed by the more specific North Central River Health Strategy (NCRHS) prepared by the North Central Catchment Management Authority (NCCMA). The NCRHS provides the framework for local communities to work in partnership with Government to manage and restore our rivers and waterways over the long term.

This report has been produced to support the NCCMA in developing a plan to protect and enhance the natural environment of the Upper Loddon catchment. Where the NCRHS gives overall direction on issues, priorities and actions, this document aims to provide a finer scale of river health management planning to identify the specific location of actions throughout the catchment.

A critical input into the development of this Catchment Action Plan (CAP) was the involvement of the community of the Upper Loddon catchment. Through a number of community and stakeholder forums feedback was captured that reflected the community's views of issues of importance. This feedback has been used to guide actions in this Plan.

This document has intentionally been kept as straightforward as possible to help assist the NCCMA, landholders and community groups to identify where actions need to take place. This CAP provides one- to five-year detailed on-ground actions in priority areas.

This document is presented in two distinct parts. The first part contains background information such as the condition of the catchment, key management issues and challenges. The second part contains action plans and maps that detail activities to be implemented and their location.

1.1 Action summary

It is important to note that although the actions have been proposed and costed, the funding is still dependant on investment priorities of government and the ability to attract funds. The following describes the overall totals of the major works proposed and anticipated costs across all catchments.

- 113km of gorse and willow control to the value of approximately \$860,000 over 5 years.
- 41km of waterway fencing and revegetation of riparian corridor to the value of approximately \$515,000 over 5 years (costs assumes 50% of waterway already fenced, but may need minor maintenance)

- Protection and enhancement of 10 sites of very high biodiversity value to the value of approximately 200,000 over 5 years.
- 31km of fencing and revegetation to link substantial terrestrial vegetation stands with the riparian corridor to the value of approximately \$535,000 over 5 years.
- 62km of revegetation maintenance to the value of \$310,000 over 5 years.
- In addition there is an unknown level of funding that should be used to fence and protect high values and threatened flora communities. The actual figures are dependant on further survey work, but it is not unreasonable to expect investment of around \$250,000 over 5 years.

2 How this document was developed

This document was produced through a review of relevant literature, and engagement with the community and other government stakeholders. The general process undertaken is presented in Figure 1.



Figure 1- Process for developing this CAP

Review of existing information

The NCCMA has undertaken a number of investigations in relation to natural resource management that were reviewed and, where appropriate, used to develop this CAP. These documents vary in age, relevance, scope and level of detail and not all were appropriate to inform this report. The documents reviewed and their relevance to this project is further described in Appendix 2.

Community and stakeholder engagement

Engaging with the community is critical to generate awareness and to gather local knowledge. Ultimately the success of this plan can only be measured by the knowledge, desire, skill and action of all stakeholders in the catchment.

Three half day community workshops were held at Yandoit, Daylesford and Glenlyon, and one stakeholder workshop was also held in Daylesford. Further description of these workshops and the outcomes is provided in Section 8.

Field inspection

Field work was undertaken to review the information gained from other reports, the community and stakeholder engagement. Site inspections were held over a number of days with particular emphasis on assessing high value biodiversity areas within the catchment. Some images from the field work are captured in Appendix 3 and the photo point sites documented in the biodiversity maps.

Broader public consultation

A draft report was produced for consultation with the broader community to seek feedback on the priorities identified and actions proposed.

Production of report

Through incorporating feedback from the broader community, a final report was produced.

3 How to use this document

The planning and actions contained in this report will provide guidance for the NCCMA to focus its efforts on improving the health of waterways in the Upper Loddon catchment. Additionally, this document is intended to guide community groups and individual landholders who wish to undertake on-ground works in the region.

There are two maps for each of the priority waterways to avoid one map becoming too complicated. This includes a map of the biodiversity values which highlights where threatened flora communities are located and areas of high biodiversity; and a second map which clearly shows where implementing activities such as weed control, fencing and revegetation will lead to the greatest improvement in catchment health and therefore should be the focus of community effort.

It is noted and recognised that in some areas the community and individuals have been undertaking similar actions and this plan is designed to complement these works. It is also hoped that these actions will act as a catalyst in the catchment to continue to generate enthusiasm and effort long after its life of 5 years.

It is important to communicate that this plan only has highlighted the highest priority areas that should be given first preference for works sites. There is no further ranking of these sites as implementation is mostly dependant on the willingness of landholders to work with the CMA to undertake the works. If a particular property is not located within a priority area then landholders should not be discouraged from undertaking works. The Upper Loddon area is the highest value environment in the entire CMA region and any landholder who wishes to undertake fencing and revegetation works will contribute to the protection of this important catchment.

This CAP should also be used to support funding applications. It is expected that aligning works with the priorities of this CAP will help to capture project funding from both State and Federal sources.

4 Alignment with Key Strategies

There is a hierarchy of planning ranging from broad national/state type plans that provide high level planning, down to the very fine detail of planning on-ground actions. Within Victoria, the VRHS provides high level direction on waterway condition and management priorities. This provides guidance to local catchment based strategies such as the North Central Regional Catchment Strategy (NCRCS) and the NCRHS.

This CAP follows a recommendation from the NCHRS and fits at the bottom of a strategic natural resource management planning framework. The relationship between the NCRCS, NCRHS and CAP is depicted in Appendix 1.

5 Downstream Impacts

Although water quality was not raised as a high priority within the area of works, the actions recommended will have a substantial benefit to improving water quality in the downstream waterways.

Fencing and stock exclusion are key to reducing the generation of sediment and nutrients and control of invasive weed species at the top of the catchment is absolutely essential to conduct an effective weed control program in the lower parts of the Loddon Catchment.

6 Objectives of this CAP

This CAP has three main objectives that revolve around building on previous knowledge, targeting actions to make best use of limited resources, and delivering a product that reflects the community's input and seeks shared ownership with the people who contributed their time to the process.

Objective 1: Capitalise and build on previous experience, knowledge and reports

Key components of this objective are to:

- review the strategic direction and extensive work captured in the NCRCS, NCRHS and other previous reports;
- consolidate and prioritise the strategies and actions from previous reports; and
- seek input from stakeholders with local knowledge and experience.

It is acknowledged that there has already been substantial investment into understanding the catchment and river health issues of the Upper Loddon catchment. Consequently, this report is intended as a review of this work and draws out the elements relevant to this CAP.

Objective 2: Make the best use of limited resources

The successful management of our natural resources is an immense task and it is important to ensure funding is allocated to activities that will have the greatest benefit to the environment.

Key components of this objective are to:

- select areas with the highest values and highest threats and propose management intervention actions that remove threats and/or to maintain/enhance values;
- select practical actions that yield the best long term result; and
- target specific waterways, landholdings and threats.

Objective 3: Deliver a well regarded CAP

A measurement of the success of any planning report is how well it is used to guide management actions. Key components of this objective are to:

- prepare a CAP that is landowner friendly, practical and brief;
- reflect stakeholder input where appropriate; and
- produce a practical planning tool for Project Managers to direct the delivery of management actions.

7 Catchment details

7.1 North Central region

The region of the NCCMA covers approximately three million hectares or 13% of the State of Victoria (NCCMA, 2005a). Extending from the River Murray in the north, to the Central Highlands in the south; the Mount Camel Range in the east and the internally drained Avon-Richardson Basin forms part of the western border. The North Central region contains four river catchments (Campaspe, Loddon, Avoca and Avon/Richardson) as presented in Figure 2.

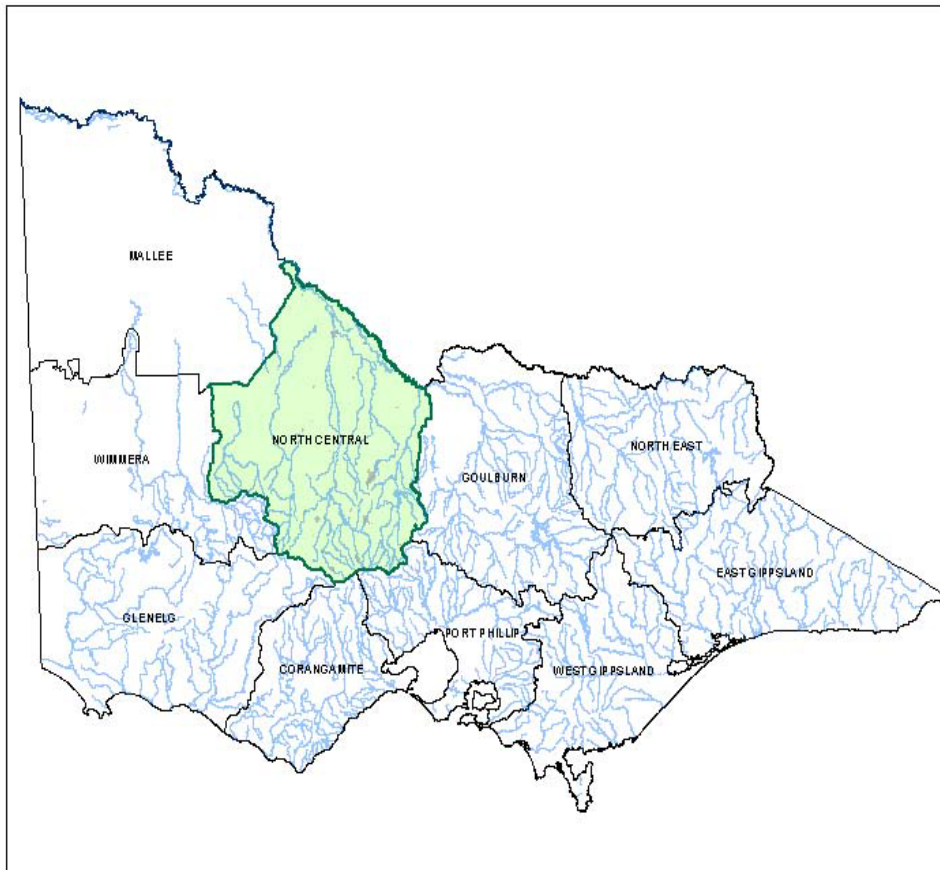


Figure 2 Region of the NCCMA

7.2 Loddon River Catchment

The Loddon River catchment (Figure 3) covers approximately 1,532,000 hectares which is about half of the entire NCCMA region (NCCMA, 2005a). The northern two thirds of the catchment comprises alluvial plains of the Murray valley with granite outcrops rising to 100 m above the plain at Mount Terrick Terrick, Mount Hope and Pyramid Hill. The southern third of the catchment largely comprises the foothills of the Great Dividing Range with altitudes of up to 741 m at Mount Alexander just north of Castlemaine (NCCMA, 2005a; NCCMA, undated). Soils vary from predominantly yellow and mottled duplex soils on the granitic and sedimentary terrain in the south to predominantly red duplex soils on the gentle slopes and alluvial plains in the north (SKM, 2003).

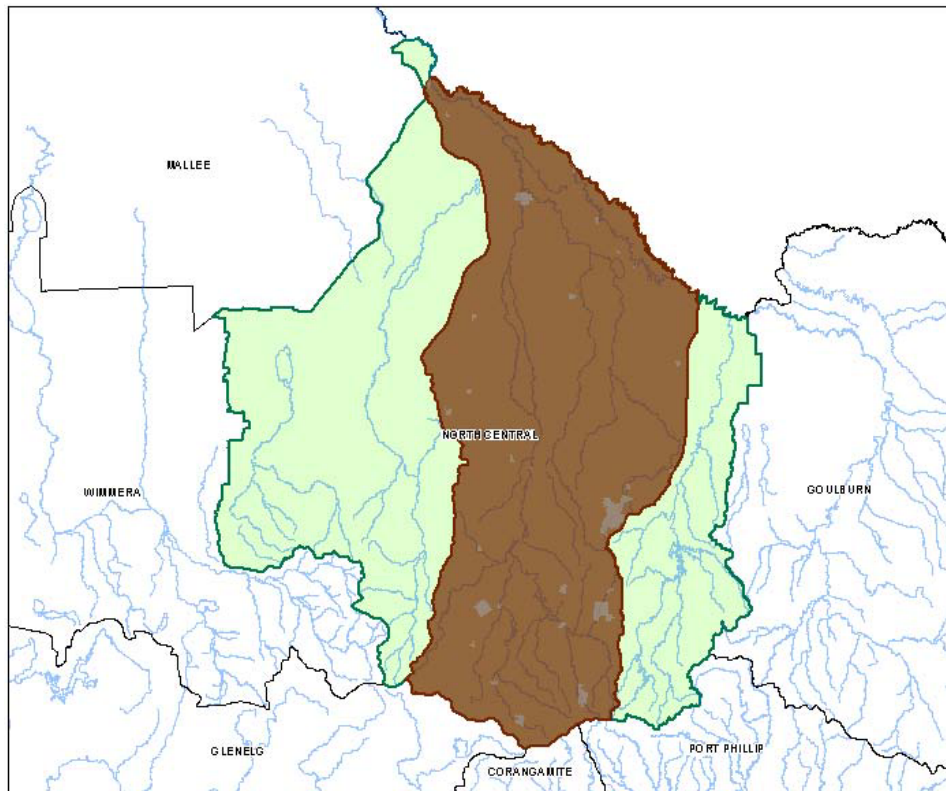


Figure 3 The Loddon River catchment

The climate varies regionally with higher temperatures and lower rainfall in the north. Average maximum daily temperature is about 25°C in the south and 30°C in the north. Average daily minimum temperature is about 11°C in the south and 15°C in the north. In the south of the catchment, average annual rainfall varies from about 460 mm (at Inglewood) to over 1200 mm (south of Hepburn Springs). In the north, average annual rainfall is typically less than 450 mm (NCCMA, 2005a; SKM, 2003).

The total length of streams in the catchment is about 3,840 km with the Loddon River the major watercourse (NCCMA, undated). The Loddon River rises on the Great Dividing Range near Daylesford and Trentham in the south and flows for approximately 430 km to the River Murray near Swan Hill (NCCMA, 2005a). The entire Loddon River catchment extends about 310 km from the Great Dividing Range to the River Murray (NCCMA, 2006; NCCMA, undated). The introduction of dams have impacted on the natural flow regime of the river and less than 20% of the waterways in the Loddon catchment have natural flow conditions. These altered flows are largely due to major water storage facilities, namely Cairn Curran, Laanecoorie and Tullaroop reservoirs (NCCMA, 2006).

The upper section of the Loddon River comprises a branched drainage pattern with storages on some tributaries established for irrigation and urban water supplies. The lower half of the catchment comprises flood effluent streams and anabranches. Major tributaries of the Loddon River include Pyramid Creek, Barr Creek, Tullaroop Creek, Bet Bet Creek, Bullock Creek, Mount Hope Creek and Bendigo Creek (SKM, 2001; NCCMA, 2005a). Kerang Lakes and Gunbower Forest are internationally recognised Ramsar wetlands in the northern (lower) part of the catchment (NCCMA, 2006).

Agricultural land use dominates the Loddon catchment including highly productive irrigation areas with extensive dairying, pasture and irrigated horticulture in the lower catchment (NCCMA, 2006). Mixed farming and cereal cropping (wheat, oats and barley) dominate the mid

and upper catchment. Apiculture and forestry also occur in the catchment. There is still significant gold mining in the Loddon catchment.

Catchment condition

Since European settlement approximately 80% of the land has been cleared for agriculture, but there are significant forested areas remaining on the slopes of the Great Dividing Range and southern hill slopes, particularly near Daylesford, Castlemaine, Maryborough and Bendigo (SKM, 2001; NCCMA, 2006).

Early European settlement of the southern half of the catchment was accelerated by the onset of the gold rush, which triggered widespread land clearance and intensive agricultural development. This had a major impact on erosion and deposition processes in the waterways of the catchment. Along the waterways of the Loddon catchment about 44% of the remaining riparian vegetation is considered to be in poor condition and only about one quarter of the total length of waterways is lined with wide, continuous native vegetation (NCCMA, 2006).

Many native vegetation communities in the Loddon catchment are considered endangered or vulnerable. These include riparian communities such as Grassy Woodland, Plains Woodland and Swampy Riparian Woodland (NCCMA, 2006). There are also many threatened flora and fauna species that are dependent on aquatic and terrestrial riparian habitats. Of the 17 species of native fish known to occur in the Loddon catchment, three are nationally threatened and six listed under the Victorian *Flora and Fauna Guarantee Act 1988* (McGuckin and Doeg, 2000).

Community

The NCCMA region's population exceeds 200,000, with most people living in the larger urban centres (NCCMA, 2005c). European exploration and settlement of the North Central region was closely linked to waterways, a vital component of many of the colony's early activities. Still today, the community places a high value on water and waterways, from which it derives many benefits including; water for irrigation, stock, domestic and industrial supply, tourism, native flora and fauna habitat, recreational and visual amenity values, regional identity and nature conservation (NCCMA, 2005a).

An intrinsic relationship between Indigenous culture and land has endured for over 40,000 years. The land continues to inform Indigenous identity and community today. Traditionally, Indigenous people have a strong affinity with waterways and water bodies, as a vital source of food, water and camping sites (NCCMA, 2006).

8 Upper Loddon Catchment – the project area

The Upper Loddon Catchment contains some of the highest value reaches in the NCCMA catchment including a number of threatened fauna and flora species and vegetation communities (NCCMA, 2005a). The catchment contains some of the few waterways in the North Central region that are rated as in 'good' condition, including Sailors Creek and Kangaroo Creek. The Upper Loddon Catchment also has some of the most extensive areas of extant native vegetation remaining in the entire North Central region (NCCMA, 2003c; NCCMA, 2005c).

This CAP covers the Loddon River catchment above the Cairn Curran and incorporates the following five reaches.

- Reach 10: Loddon River, from the confluence with Kangaroo Creek downstream to its confluence with Campbells Creek near Guildford.
- Reach 48: Loddon River, from its headwaters within the Great Dividing Range downstream to the confluence with Kangaroo Creek. The NCRHS incorporates this reach into reach 10, but this CAP considers the two sections differently.
- Reach 49: Kangaroo Creek, from its headwaters in the Great Dividing Range downstream to its confluence with the Loddon River.
- Reach 27: Jim Crow Creek, from the confluence with the Loddon River near Strangways upstream to its confluence with Spring Creek near Shepherds Flat.
- Reach 28: Sailors Creek, from its headwaters downstream to its confluence with Spring Creek (where it becomes Jim Crow Creek).

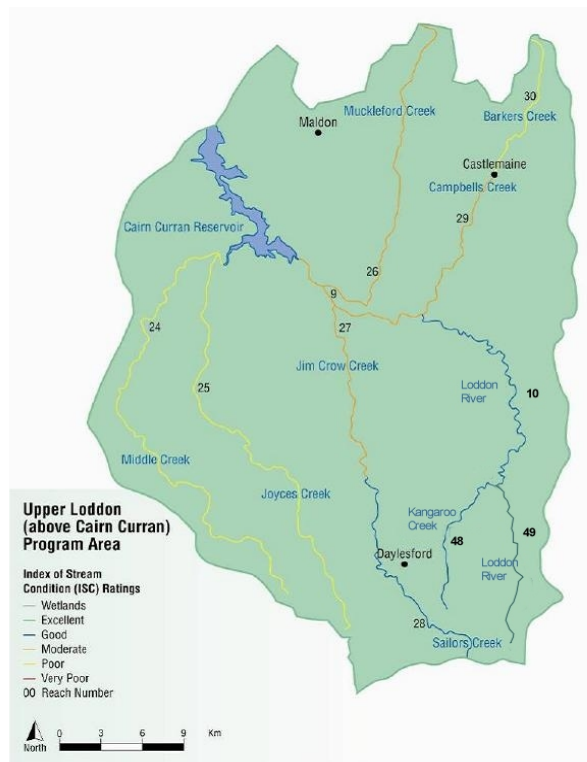


Figure 4 The project area (Upper Loddon catchment) NCCMA, 2005.

8.1 Waterway condition within project area

The NCRHS sets priorities and targets for river health management at the river reach scale (a section of stream normally around 10–30 km long) based on the Index of Stream Condition (ISC). The ISC is a state-wide approach based on five sub-indices (hydrology, physical form, streamside zone, water quality and aquatic life) that measure the extent of change from natural or ideal conditions. An overall condition rating is assigned to a reach, i.e. excellent, good, moderate, poor or very poor.

The 1999 ISC data indicates that 4% (82 km), 28% (457 km), 33% (693 km) and 35% (628 km) of waterways in the Loddon catchment are in good, moderate, poor condition and very poor condition respectively (Table 1).

Table 1 Summary of North Central waterway condition according to the 1999 ISC results

Rating	Campaspe catchment		Loddon catchment		Avoca catchment		Wimmera catchment		Total rating %
	% of length	Length (km)	% of length	Length (km)	% of length	Length (km)	% of length	Length (km)	
Excellent	0	0	0	0	0	0	0	0	0
Good	0	0	4	82	0	0	0	0	2
Moderate	53	320	28	457	76	400	46	167	45
Poor	46	309	33	693	24	135	54	163	36
Very poor	1	8	35	626	0	0	0	0	17
Total	100	637	100	1859	100	535	100	330	100

8.2 Values, Risks and Threats

The River Values and Environmental Risk System, known as RiVERS, is a framework for the prioritisation of river health management programs based on values and threats. A value is defined as something considered to be of importance or beneficial to river health. A threat is defined as an action or a process likely to cause harm. The Victorian Waterway Managers Forum and DSE have agreed on a state-wide list of values and threats which are presented in Table 2.

Table 2 Value and threat categories assigned to the RiVERS database

Values			Threats
Environmental	Social	Economic	
Significant flora	Fishing	Water supply – irrigation	Bank erosion
Bioregional conservation status of Ecological Vegetation Class	Non-motor boats	Water supply - proclaimed catchment	Bed erosion
Significant fauna	Motor boats	Infrastructure	Barriers to native fish migration
Invertebrates observed/expected	Camping	Land value	Channel modification
Width of riparian vegetation	Swimming	Tourism	Changes to flow (flow deviation)
Longitudinal continuity of riparian vegetation	Passive recreation	Power generation	Water quality trends
Structural intactness of riparian vegetation	European heritage		Water quality attainment
Native fish observed vs expected	Listed landscape		Water quality SIGNAL
Proportion of fish introduced	Flagship species		Water temperature
Native fish migration			Algal blooms
Wetland significance			Exotic flora
Wetland rarity and depletion			Degraded riparian vegetation
Heritage river or representative river			Exotic fauna
Sites of significance			Loss of instream habitat
Ecological river health			Wetland connectivity
			Uncontrolled stock access

For each reach a value and threat was scored from one to five. While the absolute total reach score does not provide a useful comparison in isolation it does indicate the relative importance of each reach compared to another. This is useful to set priorities (see below).

In turn to determine the level of risk that a particular threat poses for a particular value at any reach the following simple equation was applied:

$$\text{Risk} = \text{Likelihood} \times \text{Consequence}$$

Consequence is a function of the relative value and threat, as indicated below.

		Threat				
		1	2	3	4	5
Value	1	1	1	1	1	2
	2	1	1	2	2	3
	3	1	2	2	3	4
	4	1	2	3	4	5
	5	2	3	4	5	5

5	Catastrophic (5)
4	Major (4)
3	Moderate (3)
2	Minor (2)
1	Insignificant (1)

5	Almost certain
4	Likely
3	Moderate
2	Unlikely
1	Rare

Likelihood (as above) is therefore a measure of the probability of that threat occurring. When values and threats are high (5) and the likelihood of the threat occurring is almost certain (5) (a risk value of 25) this indicates the need for management intervention.

The NCRHS assessed 101 reaches in the region using this risk assessment methodology and the Upper Loddon Reaches were ranked (total risk ranking) as outlined in Table 3.

Selection Criteria

Setting priorities for waterway management ensures that resources are allocated to the most important areas and issues. To determine the most important areas (priority reaches), and using the information gained from RIVERS (i.e. assessment of values, threats and risk), the NCRHS defined priority reaches based on the following principles or selection criteria:

- Principle 1: Protect and enhance ecologically healthy rivers and representative rivers
- Principle 2: Minimise risks to connected high value assets
- Principle 3: Protect and enhance reaches of high risk
- Principle 4: Protect reaches with high environmental, social and economic value
- Principle 5: Maintain and enhance community capacity, awareness, motivation and involvement across the region
- Principle 6: Protect individual sites of significance along regional waterways
- Principle 7: Prevent damage and degradation of our rivers from future development activities

These principles are founded on an important underlying tenant that is; it is more cost effective and likely to result in better environmental outcomes to focus on protecting and enhancing existing high values natural areas (called 'high value assets'), rather than restoring highly degraded areas. On this basis, the overall objective of the NCRHS is to minimise risk in order

to protect river values at 'representative' river sites. This is particularly relevant when assessing Principle 1 and 2.

Of the 101 reaches in the North Central region the NCRHS identified 56 priority reaches according to these principles. Taking into account these principles reaches 10, 48, 49 and 28 were considered to be priority reaches.

Table 3 Summary of risk assessment and assessment against priority principles.

ISC Reach No.	Principle Met	Environmental Ranking*	Social Ranking*	Economic Ranking*	Total Risk Ranking*
10, 48 and 49 (Loddon)	1, 2, 3, 4, 5, 6, 7	6	3	11	26
28 (Sailors)	1, 5, 6, 7	43	22	22	57
27 (Jim Crow)	5,6, 7	83	23	27	49

* - lower rank means greater values and threats

While reach 28 (Jim Crow Creek) was not considered a priority reach by the NCRHS because it did not meet any of the first four criteria, the community engagement process for this CAP revealed considerable existing work on this reach and strong desire from landowners for this work to continue. On this basis all the reaches in the Upper Loddon are considered priority reaches.

8.3 Flora and fauna of the project area

Vegetation communities

Some of the most extensive areas of native vegetation in the entire North Central region occur in this project area. The project area comprises two major bioregions including the Central Victorian Uplands bioregion (which comprises roughly the southern half of the catchment); and the Goldfields bioregion (see NCCMA, 2005c).

The Victorian Department of Sustainability and Environment (DSE) mapped native vegetation communities in the form of Ecological Vegetation Classes (EVCs) at a scale of 1:25,000 to 1:100,000 in the North Central region (DSE, 2008). These EVCs describe local patterns of vegetation diversity and the rarity of a particular EVC is expressed in terms of its bioregional conservation status. Each EVC is assigned one of the following conservation status categories.

- Presumed extinct
- Endangered
- Vulnerable
- Depleted
- Least Concern

Table 4 lists the main EVCs in the Upper Loddon Catchment, their conservation status and location in the project area. Most of these EVCs are considered depleted or of least concern, however some do have a more significant conservation status.

The project area also has a number of threatened EVCs (listed in Table 5) that have very limited distribution in the area.

Table 4 List of main EVCs present in Upper Loddon Catchment

Vegetation Community	EVC Number	Bioregional Conservation Status	Location in CAP area
Heathy Dry Forest	EVC 20	Least Concern	Extensive in the western, central and north-eastern part of the catchment
Shrubby Dry Forest	EVC 21	Vulnerable in Goldfields; Least Concern in Central Uplands	Extensive in southern part of catchment
Grassy Dry Forest	EVC 22	Depleted	Some areas in the western part and central of the catchment
Herb-rich Foothill Forest	EVC 23	Depleted	Extensive in southern part of catchment
Shrubby Foothill Forest	EVC 45	Least Concern in Central Uplands	Extensive in southern part of catchment
Valley Grassy Forest	EVC 47	Vulnerable	Fairly extensive in the central and eastern parts of the catchment.
Box Ironbark Forest	EVC 61	Depleted in Goldfields; Vulnerable in Central Uplands	Areas in the north-western part of the catchment.

Table 5 List of threatened EVCs with limited distribution in Upper Loddon (above Cairn Curran) Catchment

Vegetation Community	EVC Number	Bioregional Conservation Status	Location in CAP area
Plains Grassy Woodland	EVC 55	Endangered	A few isolated patches, mainly in the central part of the catchment (around the Yandoit and Franklinford areas)
Floodplain Riparian Woodland	EVC 56	Endangered	A few isolated patches along the Upper Loddon River east of Strangways, including one small patch just within the CAP area at the confluence of the Loddon River and Campbells Creek near Guildford.

Vegetation Community	EVC Number	Bioregional Conservation Status	Location in CAP area
Grassy Woodland/Alluvial Terraces Herb-rich Woodland	EVC 76	Endangered	A few patches in the north-western part of the catchment (south of Strangways and Newstead)
Alluvial Terraces Herb-rich Woodland/Creekline Grassy Woodland Mosaic	EVC 81	Endangered	A few small patches in the north-western part of the catchment, mainly along the lower Jim Crow Creek near Clydesdale and Yandoit.
Creekline Herb-rich Woodland	EVC 164	Endangered in Goldfields; Vulnerable in Central Uplands	A few narrow strips in the southern part of the catchment.
Grassy Woodland	EVC 175	Endangered in Central Uplands; Vulnerable in Goldfields	A few small, isolated patches, mainly in the western part of the catchment.
Stream Bank Shrubland	EVC 851	Endangered	Narrow corridor extending along Loddon River from near Tarilta south to about Glenlyon (with a few gaps) and also along Sailors Creek from about Shepherds Flat south to Daylesford.

Threatened flora species

In addition to the threatened communities, there are a number of individual threatened flora and fauna species that have been recorded within the Upper Loddon catchment area (NCCMA, 2003c). A search of the Viridans (2005) database was undertaken and the threatened flora species recorded within this CAP area are presented in Table 6. Where the information is available the general locations of these flora species are shown in the high value biodiversity areas presented in Figures 5, 7, 9, and 10.

Table 6 Threatened flora species recorded from Viridans (2005) database in Upper Loddon catchment (above Cairn Curran).

Common Name	Scientific Name	FFG Listed	DSE Status	Location in CAP area
Midlands Spider Orchid	<i>Caladenia sp. aff. concolor</i>		Vulnerable	A record near Sailors Creek, south-west of Bryces Flat; another record in dry forest just north-east of Porcupine Ridge

Common Name	Scientific Name	FFG Listed	DSE Status	Location in CAP area
Spotted Hyacinth Orchid	<i>Dipodium pardalimum</i>		Rare	A record just south-west of Musk
Woodland Plume-orchid	<i>Pterostylis sp. aff. plumulosa</i>		Rare	A record in dry forest just north-east of Porcupine Ridge
Drooping Sheoak	<i>Allocasuarina luehmannii</i>	Listed		A record in woodland just west of Clydesdale
Wiry Bossiaea	<i>Bossiaea cordigera</i>		Rare	Several records in forest in southern part of catchment, near Bullarto
River Leafless Bossiaea	<i>Bossiaea riparia</i>		Rare	A record near Sailors Creek just north of Bryces Flat
Scented Bush-pea	<i>Pultanaea graveolans</i>	Listed	Rare	Record in forest in north-eastern part of catchment, south-west of Glenluce.
Wombat Bush-pea	<i>Pultanaea reflexifolia</i>		Rare	Several records in forest in southern part of catchment
Swamp Bush-pea	<i>Pultanaea weindorferi</i>		Rare	Small number of records in southern part of catchment
Southern Swainson-pea	<i>Swainsona behriana</i>		Rare	Record near Sailors Creek, south-west of Bryces Flat
Sticky Wattle	<i>Acacia howittii</i>		Rare	Record just south of Porcupine Ridge
Dwarf Silver Wattle	<i>Acacia nano-dealbata</i>		Rare	Record just south of Musk
Brooker's Gum	<i>Eucalyptus brookeriana</i>		Rare	Several records in forest in south-eastern part of catchment, near Bullarto.
Yarra Gum	<i>E. yarraensis</i>		Rare	Several records in forest in southern part of catchment, near Bullarto South
Goldfield's Grevillea	<i>Grevillea dryophylla</i>		Rare	Record just west of Clydesdale
Fryerstown Grevillea	<i>Grevillea obtecta</i>		Rare	Records in forest in north-eastern part of catchment, west of Glenluce
Creeping Grevillea	<i>Grevillea repens</i>		Rare	Records in south-western part of catchment, west of Daylesford

Common Name	Scientific Name	FFG Listed	DSE Status	Location in CAP area
Spiny Rice-flower	<i>Pimelea spinescens</i>	Listed	Endangered	Record just south of Loddon River, south-east of Strangways

Threatened fauna species

In addition there are a number of threatened fauna species that have been recorded within the Upper Loddon catchment area. Table 7 lists threatened fauna species recorded within the CAP area based on a search of the Viridans (2005) database.

Table 7 Threatened fauna species recorded from Viridans (2005) database in Upper Loddon (above Cairn Curran) catchment.

Common Name	Scientific Name	FFG Listed	DSE Status	Location in CAP area
MAMMALS				
Brush-tailed Phascogale	<i>Phascogale tapoatafa</i>	Listed	Vulnerable	Recorded at several locations, mainly in southern and western part of catchment
Common Bent-wing Bat	<i>Miniopterus schreibersii</i>	Listed		Record to west of Shepherds Flat
BIRDS				
Grey Goshawk	<i>Accipiter novaehollandiae</i>		Vulnerable	Two records near Vaughan; one record near Daylesford
Square-tailed Kite	<i>Lophoicincta isura</i>	Listed	Vulnerable	Record south-east of Eberys
Spotted Quail-thrush	<i>Cinclosoma punctatum</i>		Near-threatened	A few records, mainly south-east of Vaughan and near Hepburn
Brown Treecreeper	<i>Climactaris picumnus</i>		Near-threatened	Several records, mainly in north-east and western part of catchment
Painted Honeyeater	<i>Grantiella picta</i>	Listed	Vulnerable	Record south-east of Eberys
Speckled Warbler	<i>Chthonicola saggittata</i>	Listed	Vulnerable	A few records in north-western part of catchment and south-east of Shepherds Flat
Hooded Robin	<i>Melanodryas cucullata</i>	Listed	Near-threatened	Three records in north-western part of catchment

Common Name	Scientific Name	FFG Listed	DSE Status	Location in CAP area
Diamond Firetail	<i>Stagonopleura guttata</i>	Listed	Vulnerable	A few records in north-western part of catchment
Powerful Owl	<i>Ninox strenua</i>	Listed	Vulnerable	A few records in southern part of catchment
Swift Parrot	<i>Lathamus discolor</i>	Listed	Endangered	A few records in north-western part of catchment
FROGS				
Growling Grass Frog	<i>Litoria raniformis</i>	Listed	Endangered	Record on Jim Crow Creek west of Franklindford

These threatened communities and individual plants and animals have been considered in the CAP actions. However, it should be noted that actions are often not specific for an individual species, instead focusing activities on the preservation of areas of high habitat value, or revegetation works to connect isolated stands of remnant vegetation.

8.4 Biodiversity maps

Table 5 draws out the most threatened EVC's within the project area and these have been mapped and presented in Figures 5, 7, 9 and 11. The quality of these sites is largely not known and it has been recommended that a field inspection is undertaken to confirm the boundary of the mapped site and to determine its current level of protection and threats.

These areas should be considered a high priority and fencing, stock exclusion, weed and vermin control are all expected activities in these areas. These actions have not been costed and presented in the CAP actions (Figures 6, 8, 10 and 11) as further investigation is required first.

9 Community feedback

As part of the process to develop this CAP the community was engaged to help set priorities and actions. Three half day community workshops were held at Daylesford, Yandoit and Glenlyon and attracted a diverse range of community participants. These workshops were used to;

- outline the background, purpose and content of the CAP;
- capture community and stakeholder comment and views on what issues are important, what actions should be pursued, and where these issues are located;
- test the NCRHS priorities (i.e. do the NCRHS priorities align with the community); and
- build community ownership, awareness and joint action

Table 8 captures the key messages and issues of concern raised by the community. Feedback and direction on these issues has been incorporated into the CAP where appropriate.

Table 8 Community issues and incorporation into CAP

CONCERN RAISED	RESPONSE	INCORPORATED INTO ACTION PLANS
Loss of large water holes/sediment build up	Issue principally climate driven and cannot be easily addressed through management actions.	No
Wildlife preservation	Improve habitat values by excluding stock, weed control and revegetation activities.	Yes
Low/no flows	Issue principally climate driven and cannot be addressed through management actions.	No
Recreational activities (i.e. 4WD) in state forest	Information provided to Parks Victoria and DSE and action item captured.	Yes
Residual mercury levels in waterways	A sediment testing program will be undertaken to determine the extent of the issue.	Yes
Isolated remnant stands contribute to a decline in vegetation health	Linking corridors has been incorporated into the CAP	Yes
Council stormwater management	Stormwater Management plans have been produced and follow up is required. CMA will continue to drive action through their Local Government Liaison Officer and Water Quality Manager.	No
Weeds (various species)	Control weeds in priority areas to protect high value vegetation.	Yes
Pest animals	Undertake further investigation to determine extent of this concern.	Yes

CONCERN RAISED	RESPONSE	INCORPORATED INTO ACTION PLANS
Provenance of revegetation plantings	Noted by the CMA that some plantings have been an inappropriate provenance. Best Practice Vegetation Management Guidelines has been loaded onto the CMA webpage and used to guide all revegetation activity.	No
Need to be more sensitive in staging to preserve habitat values	Noted by the CMA and although there is no specific action, there is strong agreement about the need to stage works properly.	No
If a particular waterway is deemed 'low value' does it mean that they can not receive any funding	There is no action, but reinforced that work should be proactively targeted to priority areas, but it should not excluded landholders in this high value catchment who wish to undertake fencing, weed control and revegetation.	No
The Strategy needs to extend to a timeframe that fully allows the understanding of catchment change	The actions proposed do consider this and the ongoing monitoring and evaluation is used to understand the success of the works and the catchment response. There is a formalised review process at the end of the life of this plan to review success and lessons learnt.	No
Will the progress of catchment change be measured?	There is a monitoring program proposed.	Yes
How was the RRHS created, what process was undertaken, what was the scientific rigor?	The RRHS document communicates the process of how the data was collected and used. It is suggested that in the first instance this document is read, then undertake verbal discussion with CMA staff where there are still questions.	No
The risk ranking of exotic flora in the RRHS is likely to be a bit low in the threat scoring. The scoring should be pushed up to 5	This is agreed by the CMA. The purpose of this CAP is to provide a finer level of detail through engagement with the community and other stakeholders. This finding has been incorporated into this CAP through a very strong focus on weed management.	Yes
The CMA has very little liaison with DSE who has a large responsibility to manage weeds on public land.	The CMA does actively engage with all other agencies and will initiate discussion on the actions documented in this CAP. The CMA pursues an approach to involve DSE into most projects through involvement in steering and technical committees.	No

10 Priorities

It is important that the CAP focuses action on high priority areas and issues. Without this focus, funding and effort is likely to be spread throughout the catchment and into lower priority areas which is not an effective use of limited resources. Additionally, if activities are not concentrated on high priority areas potentially high value areas will decline in quality as a result.

There were a number of issues raised during the creation of this document and a filtering exercise was undertaken to identify the most important actions to undertake in the next 5 years. It is important to note that the other actions have not been disregarded altogether but marked for review in the next five year plan.

The following captures the issues raised during the development of this Plan and comments on their inclusion or exclusion.

10.1 Weeds

The overwhelming feedback from the community on the highest priority catchment issue is weed invasion. It was noted that both established weed species (willow, gorse, blackberry) and newly invading species (broome, hemlock and serrated tussock) were issues of concern.

Priority of issue and inclusion into this CAP

High

Weed management is a key component of this CAP and is applicable to all reaches.

10.2 Connectivity

There are a number of stands of vegetation that are surrounded by cleared farm land and have no connectivity with riparian corridors or other stands of vegetation. This likely prohibits some fauna from moving to permit breeding and foraging.

Priority of issue and inclusion into this CAP

High

Improving connectivity especially between the vegetation along riparian corridors and terrestrial stands is a high priority for this CAP.

10.3 Fencing

Areas such as Jim Crow Creek have already had major lengths of waterway fenced and further fencing and stock access was not flagged as a high priority by the community. Fencing and stock exclusion are however vital works to protect waterways and this activity is still considered very important in areas of high value if not already fenced.

Priority of issue and inclusion into this CAP

High

Fencing of all high values areas is the only way to exclude stock to protect the banks, improve water quality and allow for revegetation and natural regeneration.

10.4 Revegetation & regeneration

Revegetation (planting trees and shrubs) and regeneration (naturally germinating trees and shrubs) are both important activities in the catchment. Revegetation activities should be targeted to increasing the buffer width of waterways and connecting isolated stands of vegetation. Natural regeneration is normally a result of excluding stock and effective weed control.

Priority of issue and inclusion into this CAP

High

Revegetation and regeneration are both important aspects of this CAP and actions have been included.

10.5 Interaction between agencies

The need for better communication, coordination and interaction between agencies was raised as an issue by the community. Greater integration and sharing of resources between Parks Victoria, the DPI and the NCCMA is particularly important with regard to State Forests, Parks and adjacent freehold rural properties.

Priority of issue and inclusion into this CAP

High

Improved interaction between agencies is a priority issue, but has not been specifically included as an on-ground action for the CAP. It is however an action that the CMA, DSE, DPI, and local government need to consider in regards to coordination of the actions captured in this CAP.

10.6 Water resource management

With the ongoing dry conditions, water resource management was flagged as a key issue by the community. Concerns were raised regarding the number of dams in the catchment and their impact on water reaching the waterways. In addition, there was concern raised over the pumping of groundwater and decreases in base flows in the waterways.

Priority of issue and inclusion into this CAP

High

The improved management of water resources must be a high priority for the Upper Loddon but it is also an issue shared by most other catchments in Victoria. This CAP is not the most appropriate tool to address this concern as it requires a State based approach. It is suggested that as these issues continue to arise the community and other stakeholders engage to provide their views and perspectives.

10.7 Threatened terrestrial EVC's

Within the catchment there are a number of threatened vegetation communities (Table 5) that support an array of threatened flora and fauna. There is little information regarding the condition and level of protection of these communities.

Priority of issue and inclusion into this CAP

High

It is important to begin a process of determining the health of these threatened EVCs, fencing and rehabilitating, and where possible improving connectivity to riparian corridors.

10.8 Instream barriers.

A review of previous work that identified instream barriers issues indicated that there were no barriers sufficient to impact on fish movement in the Project Area. However, during the community consultation two sites of potential barriers were identified.

Priority of issue and inclusion into this CAP

Med

With the identification of possible barriers, an investigation of these barriers has been included into the actions.

10.9 Pest animals

Pest Animals were raised at a number of the community forums and concerns included rabbits, pigs, goats and kangaroo's. However, the view of community and government stakeholders varied dramatically and as such it was hard to pinpoint any specific activity in any specific area.

Priority of issue and inclusion into this CAP

Med

This is an issue that requires further investigation to understand the level of impact and if any control activity is required.

10.10 Salinity

Salinity concerns in the catchment were identified through the literature review, but when tested with the community and government stakeholders were not considered an issue. It is possible that the ongoing drought has reduced groundwater levels and subsequently impacted on saline discharge sites.

Priority of issue and inclusion into this CAP

Low

Given the low priority with community and government stakeholders, this CAP does not include any direct activity to address salinity.

10.11 Water quality

Water quality was originally flagged as a potential issue within the catchment, however after reviewing appropriate literature and discussion with the community and other stakeholders, there did not appear to be any evidence that water quality was a significant issue within the catchment.

Priority of issue and inclusion into this CAP

Low

Given the lack of evidence that water quality is an issue, this CAP does not include any direct activity to address water quality.

10.12 Recreation impact

The impact from four wheel drive vehicles and motorbikes are noted in areas of public land. It is acknowledged that this is an issue, but compared to the other issues and the overall impact on the health of the catchment it has been classified as a low priority.

This does not mean that agencies responsible for public land management should not deal with the issue, but in terms of this CAP and focusing effort on the most important actions to improve catchment health it is considered a low priority.

Priority of issue and inclusion into this CAP

Low

Parks Victoria and DSE should pursue activity to manage recreational impact on state land. Although a low priority, specific actions have been included in this CAP .

10.13 Sediment build up

Sediment build up in waterways is a result of the ongoing drought and lack of sufficient flows to mobilise the sediment. There are few solutions to this issue other than excavation or in some cases the installation of engineered structures to create scour holes. Both these options are expensive and not appropriate solutions for the Upper Loddon.

Priority of issue and inclusion into this CAP

Low

It is acknowledged that sediment build up in the waterway is an issue; however the most appropriate action is to wait until a flood event moves through the system. There are no actions specifically to address sediment build-up in this CAP.

11 Loddon River (Reach 10) Action Plan

11.1 Condition and Vision

Reach 10 of the Loddon River is considered in 'near' ecologically healthy condition with significant flora and fauna values. However, this reach is principally threatened by invasive weeds and stock access in some areas.

A unique aspect of this reach is the large amount of public land with a thin cleared area of the floodplain dividing very large stands of remnant vegetation. A key objective for this reach is to improve the linkages across this floodplain area.

The vision for this creek is that by 2021 it will meet the criteria for 'ecologically healthy' (NCCMA, 2005). To achieve this, weed management is important and there is a need to control gorse, blackberry and willow and eradicate all newly emerging weed threats including broome, hemlock, serrated tussock and seeding willow. The waterway will be fenced to exclude stock and large terrestrial stands of vegetation connected to the waterway through the planting of wildlife corridors. It is expected that threatened species such as the Painted honey eater will become more common.

The waterway will continue to provide high social values and recreational pursuits such as boating, and fishing will improve as the health of the reach continues to improve.

11.2 High value areas

There are two very high value areas that were identified and targeted in this CAP.

Table 9 High value areas of the Loddon River (Reach 10)

Site marked on map	Values
9	Area of very good riparian habitat and relatively weed free. Likely to provide very good fauna values. Painted honey eater has been noted in the area
10	Area of very good riparian habitat and relatively weed free. Likely to provide very good fauna values

11.3 Action priorities

Table 10 Action priorities for the Loddon River (Reach 10)

Action	High	Med	Low
Control of gorse	X		
Protect areas of very high value vegetation (refer to Table 9)	X		
Control of willow	X		
Link large areas of public land forest through the cleared floodplain	X		
Control of blackberry		X	
Protect high value EVC areas		X	

Please note: For clarification of budget numbers please refer to Appendix 4.

Table 11 Loddon River (Reach 10) Action table

Action	Extent	Year					Output Target for action	Outcome Target for reach	Cost	Responsibility
		1	2	3	4	5				
Undertake gorse and willow control along identified reaches of waterway especially around Guilford, Tarilta and Vaughan. (Riparian Works Fig 6)	9 km	X	X	X	X	X	Gorse and willow significantly controlled in most areas of the catchment.	Improvement by one ISC score in the measure of riparian condition within the area of works.	\$71,028 ¹	Landholders with support from NCCMA and DPI where appropriate
Survey the extent and quality of waterway fencing and where needed fence and revegetate the riparian corridor along identified reaches (Riparian Works Fig 6)	9 km	X	X	X			Fencing installed and stock adequately excluded. Plant survival rate at least 80% at two years. Weeds controlled within fenced area for the first three years.	Improvement by one ISC score in the measure of riparian condition within the area of works.	\$148,500 ²	Landholders with support from NCCMA and DPI where appropriate
Undertake fencing and intensive weed control and revegetation in identified high value biodiversity areas (Sites 9 & 10, Fig 5)	2 sites	X	X				Remnant vegetation and waterway corridor to be fenced and eradication of gorse, willow, blackberry, broom, hemlock and serrated tussock.	Increased presence of threatened flora and fauna. Improvement by one ISC score in the measure of riparian condition within the area of works where along a waterway.	\$40,000 ³	Landholders with support from NCCMA and DPI where appropriate
Fence and revegetate to link areas of high value terrestrial vegetation to the main waterway corridor (Linking Vegetation Fig 6)	7 km	X	X	X	X	X	Fencing installed and stock adequately excluded. (aim 25m buffer and 4 rows of vegetation). Plant survival rate at least 80% at two years. Weeds controlled within fenced area for the first three years.	Demonstrated movement of fauna species along the corridor.	\$129,500 ⁴	Landholders with support from NCCMA and DPI where appropriate
Verify the presence and health of threatened terrestrial EVC's. Engage with landholders to understand the values and threats. (Sites identified Fig 5)	8 sites	X	X				All sites of threatened terrestrial EVC's are assessed to determine their health and current level of protection. Where there is strong landholder support, instigate fencing and weed control activity.	Demonstrated improvement in the health of vegetation.	TBD based on extent of works required	NCCMA/DSE
Investigate potential instream fish barriers at Vaughan (Sites identified Fig 5)	2 sites	X					Understand if the identified sites are actually barriers to fish movement.	No fish barriers in the Upper Avoca Catchment	Minimal	NCCMA
Undertake maintenance on all new plantings to protect plants and control weeds (all sites)	16 km	X	X	X	X	X	All new areas of revegetation are maintained with appropriate weed control.	80% survival of all plants.	\$16,000 ⁵ per annum	Landholders with support from NCCMA and DPI where appropriate

Figure 5 – Biodiversity Values – Reach 10 (Upper Loddon River)

(insert page for Figure 5 (A3) here)

Figure 6 – CAP Actions – Reach 10 (Upper Loddon River)

(insert page for Figure 6 (A3) here)

12 Loddon River (Reach 48) & Kangaroo Creek (Reach 49) Action Plan

12.1 Condition and Vision

Both of these reaches are in 'near' ecologically healthy condition with significant flora and fauna values. However, this reach is principally threatened by invasive weeds and in some areas stock access.

The vision for this waterway is to control gorse, blackberry and willow and eradicate all newly emerging weed threats including, broome, hemlock and serrated tussock, and seeding willow. The waterway will be fenced to exclude stock and large terrestrial stands of vegetation connected to the waterway through the planting of wildlife corridors.

12.2 High value areas

There were no high value areas identified through this process.

12.3 Action priorities

Table 12 Action priorities for the Loddon River (Reach 48) and Kangaroo Creek (Reach 49)

Action	High	Med	Low
Control of gorse	X		
Control of willow	X		
Connect riparian corridor to terrestrial vegetation stands		X	
Protect high value EVC areas		X	
Control of blackberry		X	

Table 13 Loddon River (Reach 48) & Kangaroo Creek (Reach 49) Action table

Action	Extent	Year					Output Target for action	Outcome Target for reach	Cost	Responsibility
		1	2	3	4	5				
Undertake gorse and willow control along identified reaches of waterway. (Riparian Works Fig 8)	15 km	X	X	X	X	X	Gorse and willow significantly controlled in most areas of the catchment	Improvement by one ISC score in the measure of riparian condition within the area of works.	\$118,380 ¹	Landholders with support from NCCMA and DPI where appropriate
Survey the extent and quality of fencing and where needed fence and revegetate the riparian corridor along identified reaches (Riparian Works Fig 8)	15 km	X	X				Fencing installed and stock adequately excluded. Plant survival rate at least 80% at two years. Weeds controlled within fenced area for the first three years	Improvement by one ISC score in the measure of riparian condition within the area of works.	\$247,500 ²	Landholders with support from NCCMA and DPI where appropriate
Fence and revegetate to link areas of high value terrestrial vegetation to the main waterway corridor (Linking Vegetation Fig 8)	10 km	X	X	X	X	X	Fencing installed and stock adequately excluded. (aim 25m buffer and 4 rows of vegetation)Plant survival rate at least 80% at two years. Weeds controlled within fenced area for the first three years.	Increased presence of threatened flora and fauna. Improvement by one ISC score in the measure of riparian condition within the area of works where along a waterway	\$185,000 ⁴	Landholders with support from NCCMA and DPI where appropriate
Verify the presence and health of threatened terrestrial EVC's. Engage with landholders to understand the values and threats (Sites identified Fig 7)	7 sites	X	X				All sites of threatened terrestrial EVC's are assessed to determine their health and current level of protection. Where there is strong landholder support, instigate fencing and weed control activity.	Demonstrated improvement in the health of vegetation	TBD based on extent of works required	NCCMA/DSE
Work with community to understand public land management concerns better in the forested areas between Wheatchef and Lyonville	N/A	X	X				More regular and improved communication between the CMA and other government agencies.	Improve management of public land, sharing of resources and knowledge and more private land works adjacent to high value areas of public land	Minimal	NCCMA/DSE/DPI/PV
Undertake maintenance on all new plantings to protect plants and control weeds (all sites fig 7 & 8)	25km		X	X	X	X	All new areas of revegetation are maintained with appropriate weed control.	80% survival of all plants.	\$25,000 ⁵ per annum	Landholders with support from NCCMA and DPI where appropriate

Figure 7 – Biodiversity Values – Reach 48 (Kangaroo Creek) & Reach 49 (Upper Loddon River)

(Insert page for Figure 7 (A3) here)

Figure 8 – CAP Actions – Reach 48 (Kangaroo Creek) & Reach 49 (Upper Loddon River)

(Insert page for Figure 8 (A3) here)

13 Jim Crow Creek (Reach 27) Action Plan

13.1 Condition and Vision

The Jim Crow Creek has some good values but is significantly compromised by gorse and in some areas stock access to the waterway. This catchment has a number of high value areas and through the community engagement it is understood that a large portion of the waterway is already fenced off and hence fencing does not form a key action. The area does however have some waterway erosion which largely can be controlled by adequate stock management.

The vision for this reach is to have the gorse largely controlled in the catchment and eradication of all newly emerging weed threats including broome, hemlock and serrated tussock. Stock will be excluded from the waterway and a healthy riparian corridor created. It is also expected that all high value areas will be managed to protect and enhance key areas of threatened flora and fauna which will result in increased populations of Growling Grass Frog, Hooded Robin, Swift Parrot, Square-tailed Kite, Speckled Warbler Brush-tailed Phascogale, and Spiny Rice-flower

13.2 High value areas

There are five high value areas that were identified and targeted in this CAP.

Table 14 High value areas of Jim Crow Creek (Reach 27)

Site marked on map	Values
4	High quality woodland and riparian habitat; Growling Grass Frog recorded in area.
5	High fauna diversity, including threatened species such as Hooded Robin, Swift Parrot, Square-tailed Kite, Speckled Warbler and Brush-tailed Phascogale.
6	Records of threatened Brush-tailed Phascogale.
7	Records of Swift Parrots.
8	Spiny Rice-flower (listed critically endangered under EPBC act) recorded in area.

13.3 Action priorities

Table 15 Action priorities for Jim Crow Creek (Reach 27)

Action	High	Med	Low
Control of gorse	X		
Protect areas of very high value vegetation	X		
Protect areas with threatened species (refer to Table 14)	X		
Control of blackberry		X	
Control active areas of waterway erosion		X	
Investigate and protect high value terrestrial EVC areas		X	
Connect riparian corridor to terrestrial vegetation stands		X	

Table 16 Jim Crow Creek (Reach 27) Action table

Action	Extent	Year					Output Target for action	Outcome Target for reach	Cost	Responsibility
		1	2	3	4	5				
Undertake gorse control along identified reaches of waterway (Riparian Works Fig 10)	65km	X	X	X	X	X	Gorse significantly controlled in most areas of the catchment	Improvement by one ISC score in the measure of riparian condition within the area of works	\$512,980 ¹	Landholders with support from NCCMA and DPI where appropriate
Undertake fencing and intensive weed control and revegetation in identified high value biodiversity areas (Sites identified in Fig 9)	5 sites	X	X				Remnant vegetation and waterway corridor to be fenced and eradication of gorse, willow, blackberry, broom, hemlock and serrated tussock.	Increased presence of threatened flora and fauna. Improvement by one ISC score in the measure of riparian condition within the area of works	\$100,000 ³	Landholders with support from NCCMA and DPI where appropriate
Fence and revegetate priority areas to link areas of high value terrestrial vegetation to the main waterway corridor. (Linking Vegetation Fig 10)	7km	X	X	X	X	X	Fencing installed and stock adequately excluded. (aim 25m buffer and 4 rows of vegetation). Plant survival rate at least 80% at two years. Weeds controlled within fenced area for the first three years	Increased presence of threatened flora and fauna.	\$91,000 ⁴	Landholders with support from NCCMA and DPI where appropriate
Verify the presence and health of threatened terrestrial EVC's. Engage with landholders to understand the values and threats (Sites identified Fig 9)	34 sites	X	X	X	X		All sites of threatened terrestrial EVC's are assessed to determine their health and current level of protection. Where there is strong landholder support, instigate fencing and weed control activity.	Demonstrated improvement in the health of vegetation	TBD based on extent of works required	NCCMA/DSE
Undertake a flora survey of Site 8 to identify presence and extent of <i>Pimelea spinescens</i> (Spiny rice-flower) and install stock exclusion fencing where required. (Fig 9)	1 site	X					Populations of Spiny rice-flower are identified and fenced to exclude stock.	Species protected and increased population	\$10,000	NCCMA/DSE
Undertake fencing and revegetation works in areas of active channel erosion (erosion control Fig 10)	7km	X	X	X			Fencing installed and stock adequately excluded. Plant survival rate at least 80% at two years. Weeds controlled within fenced area for the first three years. Where necessary undertake further geomorphic assessment	No active waterway erosion.	\$115,500 ⁶	Landholders with support from NCCMA and DPI where appropriate
Undertake maintenance on all new plantings to protect plants and control weeds	14km	X	X	X	X	X	All new areas of revegetation are maintained with appropriate weed control.	80% survival of all plants.	\$14,000 ⁵ per annum	Landholders with support from NCCMA and DPI where appropriate

Catchment Action Plan:
Upper Loddon Catchment

Figure 9 – Biodiversity Values – Reach 27 (Jim Crow Creek)

(Insert page for Figure 9 (A3) here)

Figure 10 – CAP Actions – Reach 27 (Jim Crow Creek)

(Insert page for Figure 10 (A3) here)

14 Sailors Creek (Reach 28)

14.1 Condition and Vision

Sailor Creek is a waterway in 'near' ecologically healthy condition and has a number of high value areas with high value species. It has very good riparian vegetation and good instream habitat with no obvious erosion issues. The biggest threat to this waterway and its catchment is the invasion of exotic weeds, particularly gorse and willow.

The vision for this creek is that by 2021 it will meet the criteria for 'ecologically healthy' (NCCMA, 2003). The waterway will be fenced off and stock excluded. Ongoing weed control will be undertaken on gorse, blackberry and willow and eradication of newly emerging weed threats of hemlock, broom, serrated tussock and seeding willow. There will be increased presence of Brush-tailed Phascogale, Powerful Owl, Speckled Warbler and Brown Treecreeper.

14.2 High value areas

There are three very high value areas that were identified and targeted in this CAP.

Table 17 High value areas for Sailor Creek (Reach 28)

Site marked on map	Values
1	Has very high landscape value with excellent fauna habitat. Brush-tailed Phascogale and Powerful Owl have been identified in area.
2	Important landscape feature and has potential high value fauna and in stream habitat.
3	Site has very high bird diversity including a number of threatened species including, Speckled Warbler and Brown Treecreeper.

14.3 Action priorities

Table 18 Action priorities for Sailors Creek (Reach 28)

Action	High	Med	Low
Control of gorse	X		
Protect areas of very high value vegetation	X		
Protect areas with threatened species (refer to table 14.2)	X		
Control of Willow		X	
Control of Blackberry		X	
Connect riparian corridor to terrestrial vegetation stands		X	

Table 19 Sailors Creek (Reach 28) Action Table

Action	Extent	Year					Output Target for action	Outcome Target for reach	Cost	Responsibility
		1	2	3	4	5				
Undertake gorse and willow control along identified reaches of waterway (Riparian works Fig 12)	10km	X	X	X	X	X	Gorse and willow significantly controlled in most areas of the catchment	Improvement by one ISC score in the measure of riparian condition within the area of works	\$78,920 ¹	Landholders with support from NCCMA and DPI where appropriate
Undertake gorse and willow control along identified reaches of waterway (Riparian works Fig 12)	12km	X	X	X	X	X	Gorse and willow significantly controlled in most areas of the catchment	Improvement by one ISC score in the measure of riparian condition within the area of works	\$60,000 ⁷	Landholders with support from NCCMA and DPI where appropriate
Undertake blackberry control in areas of major infestation (Blackberry Control Area Fig 12)	2km	X	X				Blackberry significantly controlled in most areas of the catchment	Improvement by one ISC score in the measure of riparian condition within the area of works	\$15,784 ¹	Landholders with support from NCCMA and DPI where appropriate
Undertake fencing and intensive weed control and revegetation in identified high value biodiversity areas (Sites identified in Fig 11)	3 sites	X	X				Remnant vegetation and waterway corridor to be fenced and eradication of gorse, willow, blackberry, broom, hemlock and serrated tussock.	Increased presence of threatened flora and fauna. Improvement by one ISC score in the measure of riparian condition within the area of works where along a waterway	\$60,000 ³	Landholders with support from NCCMA and DPI where appropriate
Fence and revegetate priority areas to link areas of high value terrestrial vegetation to the main waterway corridor (Linking Vegetation Fig 12)	7km	X	X	X			Fencing installed and stock adequately excluded. (aim 25m buffer and 4 rows of vegetation). Plant survival rate at least 80% at two years. Weeds controlled within fenced area for the first three years	Increased presence of threatened flora and fauna	\$129,500 ⁴	Landholders with support from NCCMA and DPI where appropriate
Verify the presence and health of threatened terrestrial EVC's. Engage with landholders to understand the values and threats (sites identified in Fig 11)	8 sites	X	X				All sites of threatened terrestrial EVC's are assessed to determine their health and current level of protection. Where there is strong landholder support, instigate fencing and weed control activity.	Demonstrated improvement in the health of vegetation	TBD based on extent of works required	NCCMA/DSE

Action	Extent	Year					Output Target for action	Outcome Target for reach	Cost	Responsibility
		1	2	3	4	5				
Undertake maintenance on all new plantings to protect plants and control weeds(all sites Fig 11 &12)	7km		X	X			All new areas of revegetation are maintained with appropriate weed control.	80% survival of all plants.	\$7,000 ⁵ per annum	Landholders with support from NCCMA and DPI where appropriate
Engage with EPA first and undertake sediment testing to investigate any heavy metal contamination in area from past industry (site identified in Fig 12)	1 site						Determine if heavy metals are in fact an issue for management		\$2000	NCCMA/EPA

Figure 11 – Biodiversity Values – Reach 28 (Sailors Creek)

(Insert page for Figure 11 (A3) here)

Figure 12 – CAP Actions – Reach 28 (Sailors Creek)

(Insert page for Figure 12 (A3) here)

15 Monitoring of success

The actions proposed in this Catchment Action Plan are focused on achieving outputs that over time will contribute to catchment change outcomes. The timeframe for this transition is not years but often decades, and any monitoring program needs to consider the path of outputs (actions) to outcomes.

The following describes the key actions and changes in the system that can be used to understand if the works are on the path to success.

15.1 Revegetation activities

Revegetation activities include planting plants or direct seeding and also weed and vermin control at the site. Table 20 communicates the key physical measures that can be used to check to see if the system is on the right path to success.

Table 20 Revegetation

PHYSICAL MEASURE	YEAR				
	1	8	16	24	32
Stock are excluded	Yes	Yes	Yes	Yes	Yes
Plant survival (planting of tube stock or cells)*	80%	70%	70%	50%	50%
Presence of non ground storey weeds (i.e. all weeds of under, mid and over storey, such as gorse and blackberry)	< 5%	< 5%	< 5%	< 5%	< 5%
Mid and understorey % of planting reflect EVC structure	Yes	Yes	Yes	Yes	Yes
% of planted tree and shrub species naturally recruiting*	0%	15%	30%	50%	90%

* note; it is expected that some species, such as acacias, may only have a life expectancy of 10 or 15 years and the over time the total survival numbers of planted stock will decrease. These losses are however offset by the % of planted trees and shrubs natural recruiting to create a sustainable vegetation system.

15.2 Stock exclusion

Stock exclusion refers to fence construction and ongoing maintenance of fencing and gates to exclude (or manage) stock grazing of the protected site.

Table 21 Stock exclusion fencing

PHYSICAL MEASURE	YEAR				
	1	3	5	10	20
Stock are excluded	Yes	Yes	Yes	Yes	Yes
Natural regeneration of indigenous species	No	Yes	Yes	Yes	Yes
Diversity of original EVC recruiting (under, mid and over storey only)	0%	10%	30%	60%	80%

15.3 Erosion

Erosion issues within this CAP area appear to be relatively limited. Table 22 provides the expected physical measures that can be seen for any erosion control activities.

Table 22 Erosion

PHYSICAL MEASURE	YEAR				
	1	2	3	5	10
Stock are excluded	Yes	Yes	Yes	Yes	Yes
If grade control structures have been used, they are stable with no rock movement or outflanking visible.	N/A	Yes	Yes	Yes	Yes
Grasses (exotic) have strongly recruited to help stabilise the site.	No	Yes	Yes	Yes	Yes
No further signs of erosion	N/A	Yes	Yes	Yes	Yes
Plant survival (planting of tube stock or cells)	80%	70%	70%	70%	70%

15.4 Protection of high value areas

There are a number of very high value areas identified in this CAP area and they are very important to the ongoing protection of the threatened flora and fauna identified in the area. Table 23 captures the key physical measures that help to communicate success of the works.

Table 23 Protection of high value areas

PHYSICAL MEASURE	YEAR				
	1	3	5	10	20
Stock are excluded	Yes	Yes	Yes	Yes	Yes
There is ongoing fox, feral cat and rabbit control	Yes	Yes	Yes	Yes	Yes
Natural regeneration of indigenous species	No	Yes	Yes	Yes	Yes
Plant survival (planting of tube stock or cells)	80%	70%	70%	50%	50%
Presence of all weed species	< 5%	< 5%	< 5%	< 5%	< 5%
Total absence of declared noxious weeds	N/A	Yes	Yes	Yes	Yes
Increased presence of any key threatened species in the protected area	N/A	N/A	Yes	Yes	Yes

15.5 Monitoring program

The monitoring program is designed to be simple. The program consists of a series of site audits to assess the works against the expected trajectory of the transition of outputs to outcomes. It is suggested that one of the most important outcomes of this monitoring program is simply facilitating the ongoing communication and relationship between the CMA and landholders.

The program proposes only a small number of sites that will inform the need for any further and more detailed assessment. For instance, if the small sample indicates a substantial deviation from the expectations presented in tables 20, 21, 22 & 23, then it is suggested a greater level of effort is invested to determine if the problems are more widespread. However, if the small sample indicates a strong correlation with the expected quality, then there should be confidence that the entire works program is generally tracking well.

Monitoring programs should also be thought of as an opportunity to further develop a relationship with the landholders. The monitoring may principally inform the CMA regarding any issues with the quality of works, but the ongoing interest in landholders achievements should never be underestimated. The requirements of the monitoring program increase as the number of landholders increases, which is geared to growing the number of active relationships over the 5 years.

The following table involves the monitoring requirements for the five years of the Plan's implementation.

Table 24 Monitoring Program

Site or type of activity	Monitoring required
ISC	Standard ISC assessments should continue as part of the NCCMA program for collecting data on river health.
High value sites	<p>Inspect all high value sites annually to determine if the trajectory is aligned with Table 23 and if further works need to be done.</p> <p>This opportunity should be used to initiate discussion with adjacent landholders to discuss boundary issues, and where possible continue to negotiate extending vegetation buffers.</p>
Fencing and revegetation activities	Assess 10% of all works sites on an annual basis

16 Gaps in knowledge and further investigation

The following issues were identified as requiring more information. They are presented in priority order.

16.1 Weed mapping

There is a substantial knowledge gap in the location of key weed species especially the new invading species such as broome, hemlock and serrated tussock. In addition seeding willows are a key concern in this catchment. More effective weed control could be undertaken with a better knowledge of the location of these key weed species.

Given this is such a high value catchment and that weed invasion is the largest threat it is recommended that an appropriately qualified contractor is engaged to walk the waterway and accurately map all threatening weed species.

It is likely that this mapping exercise would cost in the order of \$20,000 - \$30,000.

16.2 Knowledge of public land condition

The knowledge of the condition of public land was limited as there was no significant input from public land managers into the process of developing this CAP. It is recommended that the CMA engage further with appropriate agencies to discuss the priorities raised and existing and future management plans.

16.3 Kangaroo management

Kangaroo populations were raised as an issue but their actual impact on public and grazing land was inconclusive. It is therefore recommended that further investigation is undertaken to better understand kangaroo numbers and their impacts in order to assess the need for any mitigation strategies.

It is expected that a study to understand the population dynamics and impacts would cost in the order of \$30,000.

16.4 Specific contamination issues

Some landholders raised concerns that elevated mercury levels exist from previous industry in the Daylesford area. It is suggested in the first instance that a one off sediment sampling program is undertaken to assess the presence of mercury and other heavy elements. This action item has been captured in the action Table 19.

Based on the results further mitigation discussions can be undertaken if required. It is expected that this action would cost around \$3,000.

16.5 Extent of goat and pig impact

The impact of goats and pigs in public land areas was also inconclusive and in some forums it raised as a high priority and in others dismissed as a priority. This suggests that further data is needed to actually understand their impact and need for control. It is recommended that a study is undertaken to determine the population dynamics and impacts. It is expected this would cost in the order of \$35,000.

16.6 Groundwater management

Groundwater management was a key issue raised within a number of the community forums. The comments were raised in the context of groundwater extraction, especially within urban areas, and the impact on base flows in waterways.

The determination of the sustainable yield of groundwater is a very complex process and often 'best guess' figures are initially allocated pending further and more detailed analysis.

This issue is likely to be a concern across much of the NCCMA region and it is suggested that the CMA review the data used to develop groundwater sustainable yields and confirm if they are sufficiently informed to protect base flow for waterways.

17 Education and training opportunities

There are three principle areas of further education and training that have been identified

17.1 Sediment accumulation in waterways

The community would benefit from more information associated with the management of sediment and debris build up in the waterway. This is a consistent issue of the upper Loddon and more broadly across the CMA region. The accumulation of sediment and woody debris is a combination of continuing input of sediment from minor upstream erosion sources and a prolonged period of low rainfall.

It is recommended that a basic understanding in stream hydrology and sediment generation and transportation would help advance the community's understanding of why sediment build up occurs and what sort of flow conditions are required to naturally manage waterway systems.

17.2 Identification of emerging weed threats

There are three principal weeds that are considered to be an emerging threat within the Upper Loddon, namely; Hemlock, Serrated Tussock and Broome. The infestations of these weeds are currently confined to small areas and with effective awareness and identification skills in the community it is highly likely that these weeds can be eradicated from the catchment.

17.3 Water resource management

Water resource management is a key issue that impacts on the health of waterways in the catchment. The community is justifiably concerned that surface dams and groundwater extraction is having an impact on the flow in the waterways.

Without doubt this is a difficult area of education as the interaction between surface and groundwater hydrology can be extremely complex. It is however suggested that the CMA consider an education and training program to assist the community understand the impact of dams and how their water capture can influence the key flow needs of waterways.

18 References

Cant, B. 2002. *Jim Crow Creek Restoration Plan*. Report produced for NCCMA. Department of Natural Resources and Environment, Victoria.

DNRE. 2002a. *Victorian River Health Strategy*. Department of Natural Resources and Environment, Victoria.

DNRE. 2002b. *Biodiversity Action Planning. Strategic Overview of the Goldfields Bioregion, Victoria*. Department of Natural Resources and Environment, Victoria.

DNRE. 2002c. *Bendigo Regional Fisheries Management Plan*. Department of Natural Resources and Environment, Victoria.

McGuckin, J. and T. Doeg. 2000. *Investigation of Aquatic Ecosystems of the Loddon Catchment. Streamline Research*. Prepared for NCCMA.

NCCMA. 2000. *North Central CMA Regional Floodplain Management Strategy*. Report for NCCMA by Egis Consulting.

NCCMA. 2003a. *North Central Regional Catchment Strategy*. North Central Catchment Management Authority, Huntly, Vic.

NCCMA. 2003b. *Draft Loddon Nutrient Management Strategy*. North Central Catchment Management Authority, Huntly, Vic.

NCCMA. 2003c. *North Central Catchment Condition Report*. North Central CMA, Huntly, Vic.

NCCMA. 2005a. *North Central River Health Strategy*. North Central Catchment Management Authority, Huntly, Vic.

NCCMA. 2005b. *North Central Waterways-Values, Threats and Risks. A supporting document to the North Central River Health Strategy*. North Central CMA, Huntly, Vic.

NCCMA. 2005c. *North Central Native Vegetation Plan*. North Central Catchment Management Authority, Huntly, Vic.

NCCMA. 2006. *Waterways of the North Central Region. Catchment and waterway descriptions. Loddon Catchment*. North Central CMA, Huntly, Vic.

NCCMA. 2007. *Draft North Central Dryland Management Plan*. North Central Catchment Management Authority, Huntly, Vic.

NCCMA. undated. *Draft Loddon River Health Strategy: A Framework for Rehabilitating Streams in the Loddon River Catchment*. North Central CMA, Huntly, Vic.

NRE 1999 and DSE 2004. Index of Stream Condition results. NCCMA. 2004. *North Central River Health Strategy – Communication Plan*.

NRE. 2001. *North Central Weed Action Plan*. North Central Catchment Management Authority, Huntly, Vic.

RMCG. 2007. *Loddon Nutrient Management Strategy: Data and Assumptions Review*. Report for North Central CMA by RMCG, Bendigo.

SKM. 2001. *Loddon Catchment Nutrient Action Plan. Parts A, B and C*. Final Report by Sinclair, Knight Merz, Armadale, Victoria.

SKM. 2003. *Upper Loddon River Geomorphological Study. Parts A and B*. Sinclair, Knight, Merz, Armadale, Victoria.

SKM. 2007. *Survey of distribution, abundance and structure of fish populations and communities – North Central CMA*. Sinclair, Knight Merz, Armadale, Victoria.

Viridans. 2005. *Just a Minute Database Victorian Animals and Plants*. Victorian Department of Sustainability and Environment and Viridans Pty Ltd.

APPENDIX 1 - Relationship Between CAPs and Other Plans/Strategies

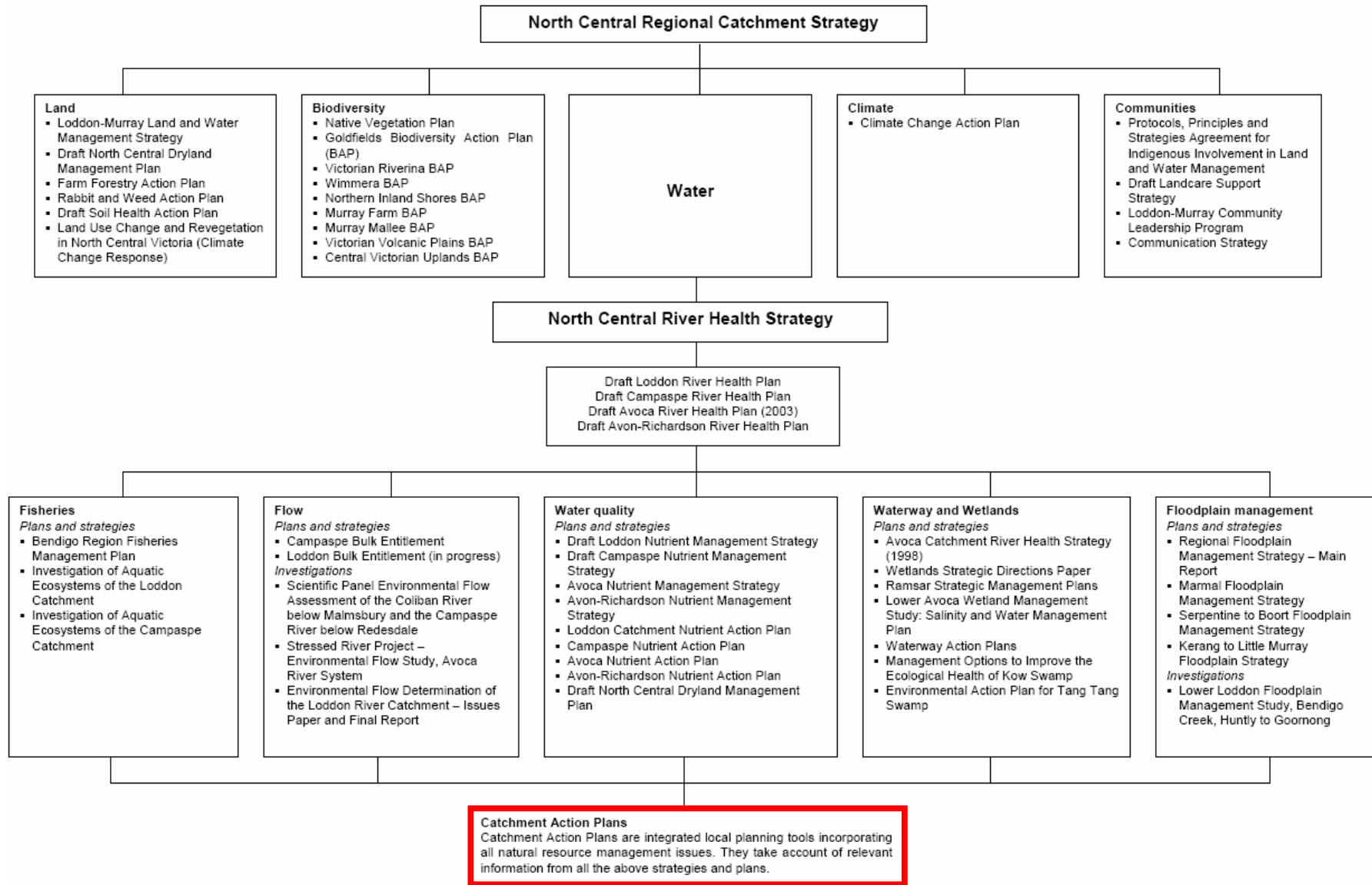


Figure A1: North Central River Health Strategy in context with the North Central Regional Catchment Strategy

Catchment Action Plan:
 Upper Loddon Catchment

APPENDIX 2 – Documents reviewed

Document	Relevance
Victorian River Health Strategy (DNRE, 2002a)	Key strategic document relevant to Upper Loddon CAP area.
North Central Regional Catchment Strategy (NCCMA, 2003a)	Key strategic document relevant to Upper Loddon CAP area.
North Central Catchment Condition Report (NCCMA, 2003c)	Key strategic document relevant to Upper Loddon CAP area.
North Central Native Vegetation Plan (NCCMA, 2005c)	Key strategic document relevant to Upper Loddon CAP area.
North Central River Health Strategy (NCCMA, 2005a)	Key strategic document relevant to Upper Loddon CAP area.
Bendigo Regional Fisheries Management Plan (DNRE, 2002c)	Key strategic document relevant to Upper Loddon CAP area.
Draft Loddon River Health Strategy (NCCMA, undated)	Provides general information on catchment and its condition at the reach and sub-reach level
Loddon Nutrient Action Plan (SKM, 2001)	Provides detailed information on catchment condition (including values and threats), water quality and nutrient management objectives at the level of management unit; also provides detailed GIS layers of prioritised nutrient action plans for entire Loddon catchment.
Loddon Nutrient Management Strategy (RCMG, 2007)	The original strategy developed in 1995 by the Loddon Waterway and Catchment Management Group aimed at outlining targets and actions to reduce nutrient loads and associated threats. The RCMG document reviews targets based on more recent models of land use, flow and nutrient concentrations.
Upper Loddon River Geo-morphological Study (SKM, 2003)	Comprehensive study of geo-morphological form and stream processes across entire Loddon catchment
Goldfields Biodiversity Action Plan (DNRE, 2002b)	This document provides general information on biodiversity (including remnant native vegetation) in the Goldfields bioregion, but does not provide reach-specific details
Jim Crow Creek Restoration Plan (Cant, 2002)	This document outlines specific actions to be undertaken to improve riparian and waterway values along Jim Crow Creek and Sailors Creek
Just a Minute database (Viridans, 2005)	Provides records of terrestrial vertebrate fauna and flora at one-minute grid resolution, including records of threatened species in Upper Loddon CAP area

APPENDIX 3 - Results of field inspection

An ENSR ecologist conducted two days inspecting the CAP area, traversing as much of the area by vehicle and foot as possible within the time-frame, mainly to verify the following:

- Community comments obtained from the consultation process concerning land management issues and land condition;
- Sites of potential importance for threatened flora and fauna (eg. areas with native vegetation, tree hollows, good riparian and in-stream habitat);
- Sites with serious weed infestations (particularly Blackberry, Gorse and willows) as well as sites with relatively few weed problems; and
- Sites potentially suitable for on-ground weed management and revegetation works.

A number of site photographs were taken during the field visit, particularly areas with extensive weed infestations or areas in relatively weed-free condition (see **Plates 1–7** for examples).

The observations gleaned from the field combined with information placed on colour aerial images of the CAP area during the community consultation process (see **Section 8**). Potential sites for revegetation and weed-control works included the following:

- Areas of extant native vegetation isolated by relatively short distances (eg. less than 1–2 km);
- Areas known to have highly significant biodiversity values (eg. threatened species or vegetation communities; see **Section 6.5**) which could benefit by enhancement or connection; and
- Areas known to have relatively few exotic weeds (particularly Blackberry, Gorse and willows).

The following plates communicate findings of interest

PLATES



Plate 1. Willow infestation on Sailors Creek just west of Daylesford.



Plate 2. Sweet Bursaria regenerating through previously sprayed Gorse, on Sailors Creek west of Daylesford.



Plate 3. Area of high bird diversity on Sailors Creek, just south of Shepherds Flat, showing open riparian habitat after removal of willows.



Plate 4. Area west of Franklinford on Jim Crow Creek, showing improved riparian values and good in-stream habitat after Gorse control.



Plate 5. Site east of Strangways, showing serious Gorse infestations on agricultural land.



Plate 6. Site near Glenluce on Loddon River showing good riparian values and lacking serious weed infestations.



Plate 7. Site on Loddon River near Vaughan showing good riparian and instream habitat and few weeds.

APPENDIX 4 - Financial calculations and assumptions

Note 1 – Control of medium to heavy woody weed infestation. This figure assumes some sites can be sprayed by vehicle mounted spray unit and others may require grooming prior to herbicide application

- Spray control includes two runs and costs \$6000 per linear km of waterway (both banks).
- Grooming costs around \$6000 per linear km of waterway (both banks).

112 km of waterway have been identified for control of medium to heavy woody weed infestation. It has been assumed that 1/3 of this length would benefit from grooming in addition to herbicide application.

37km @ \$6000 grooming & \$6000 herbicide = \$444,000

75km @ \$6000 herbicide = \$450,000

$\$444,000 + \$450,000 = 894,000/112 = \7892 (average cost per linear)

Note 2 – Fencing costs are based on \$6500/km or \$13,000/km for both sides of the waterway. It has been assumed that 50% of the current waterway is already fenced, i.e average of \$6500 per linear km (both sides of waterway)

Revegetation is based on:

$\$125/\text{rip line} \times 8 \text{ lines (8 rows – both banks)} = \1000 per linear km of waterway

$\$125/\text{spray application} \times 8 \text{ lines (8 rows – both banks)} = \1000 per linear km of waterway

$\$0.75 \times \text{plant} \times 8 \text{ rows} \times 2\text{m spacing} = 4000$ plants per linear km of waterway. $4000 \times \$0.75 = \3000 per linear km of waterway.

$\$1.25 \text{ labour per plant} = 4000 \text{ plants} \times \$1.25 = \$5000$ per linear km of waterway

$\$0.25 \text{ per guard} = 4000 \text{ plants} \times 0.25 = \1000 per linear km of waterway

Total costs = \$11,000 (average cost per linear)

Note 3 – There has been \$20,000 nominally provided to each high biodiversity value area. This funding should be used in appropriate amounts to contribute to fencing, weed control, vermin control and any revegetation activities.

Note 4 – Fencing costs are based on \$6500/km or \$13,000/km for two fence lines.

Revegetation is based on:

$\$125/\text{rip line} \times 4 \text{ lines (4 rows)} = \500 per linear km of waterway

$\$125/\text{spray application} \times 4 \text{ lines (4 rows)} = \500 per linear km of waterway

$\$0.75 \times \text{plant} \times 4 \text{ rows} \times 2\text{m spacing} = 2000$ plants per linear km. $2000 \times \$0.75 = \1500 per linear km.

$\$1.25 \text{ labour per plant} = 2000 \text{ plants} \times \$1.25 = \$2500$ per linear km of waterway

$\$0.25 \text{ per guard} = 2000 \text{ plants} \times 0.25 = \500 per linear km of waterway

Total costs = \$5,500 (average cost per linear)

Note 5 – Maintenance activity for all revegetated areas is based on \$1000/km.

Note 6 -Fencing costs are based on \$6500/km or \$13,000/km for both sides of the waterway. It has been assumed that 50% of the current waterway is already fenced, i.e average of \$6500 per linear km (both sides of waterway)

Revegetation is based on:

\$125/rip line x 8 lines (8 rows – both banks) = \$1000 per linear km of waterway

\$125/spray application x 8 lines (8 rows – both banks) = \$1000 per linear km of waterway

\$ 0.75 x plant x 8 rows x 2m spacing = 4000 plants per linear km of waterway. 4000 x \$0.75 = \$3000 per linear km of waterway.

\$1.25 labour per plant = 4000 plants x \$1.25 = \$5000 per linear km of waterway

\$0.25 per guard = 4000 plants x 0.25 = \$1000 per linear km of waterway

Total costs = \$11,000 (average cost per linear)

Note 7 - Control of light to medium woody weed spraying. Assumes that weeds are sprayed by back pack. Spray control includes two runs and costs \$5000 per linear km of waterway (both banks)