

## **Part E**

# **Risk Assessment of High Value Waterways**

## 20 Risk Assessment

To determine priority actions required to protect and maintain the high value waterways identified in Part D, a risk assessment was undertaken based on the Australian/New Zealand Standard "Risk Management AS/NZ:4360".

Risk Management is the term applied to a logical and systematic method of establishing the context, identifying, analysing, evaluating, treating, monitoring and communicating the risks associated with an activity, function or process in a way that will enable organisations to minimise losses and maximise opportunities. Risk Management is as much about identifying opportunities as avoiding and mitigating losses. (Standards Australia, 1999)

According to AS/NZ:4360:1990, risk is the chance of something happening that will have an impact upon objectives. It is measured in terms of likelihood and consequence.

### 20.1 Likelihood

The Australian/New Zealand Standard 'Risk Management AS/NZ 4360:1999' defines likelihood as a qualitative description of probability or frequency. In the context of river health, likelihood is addressed by asking: "What is the likelihood that a particular threat will impact on a particular asset?"

To answer this question, two pieces of information are required:

- the level of threat; and
- the degree of connectivity between the threat and the asset.

#### 20.1.1 Level of Threat

Waterway assets can be impacted by a vast number of specific threats. To ensure that the most appropriate (and best range of) threats were considered, the following three principles were developed:

- threats must be measurable;
- threats must be based on existing data or data that are relatively easy to collect; and
- threats must be based on data that will assist in setting priorities ie linked to objectives.

Based on these principles the threats identified in the RiVERS model were adopted.

#### 20.1.2 Degree of Connectivity

The degree of connectivity a particular threat has on a particular asset is critical in determining the likelihood that the threat will directly impact on the asset. It cannot be assumed that all threats impact on all assets equally. An example of this is shown in Table 20.1.

**Table 20.1 – Asset-Threat Connectivity for Fish Migration**

Asset	Threat	Connectivity	Justification/Assumptions
Fish Migration	Instream Barriers	High	More important in coastal drainages where up to 70% of species have a marine life phase and need to move back upstream. Loss of over 50% of species in south-eastern Australia. The importance of general movement has been underestimated for many species.
	Stock Access	Low	Not a direct threat to fish migration (unless stock completely block the stream from one bank to another!).

A matrix detailing the degree of connectivity between all threats and assets is shown in Appendix H.

#### 20.1.3 Calculating Likelihood

Having developed rules for determining threat rankings and threat/asset connectivity, rating scores for likelihood were developed as outlined in Table 20.2.

Using Table 20.2 the likelihood of a particular threat impacting on any asset can be determined.

**Table 20.2 – Likelihood Rating Scores based on Threat and Connectivity**

		Threat Ranking				
		1	2	3	4	5
Connectivity	High	1	2	3	4	5
	Moderate	1	1	1	2	3
	Low	1	1	1	1	1

## 20.2 Consequence

As the consequence of a particular threat impacting on a particular asset is directly related to the environmental value or beneficial use of that asset, for the purposes of this study, consequence equals value (refer to Table 20.3).

Based on this principle, the asset values identified in the RiVERS model were adopted.

**Table 20.3 – Consequence Rating Scores based on Value**

Value	1	2	3	4	5
Consequence	1	2	3	4	5

## 20.3 Risk Level

Having developed rules for likelihood and consequence, it is now possible to determine the level of risk for any value/threat combination as follows:

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

As the rating scores for likelihood and consequence range from 1 to 5, the minimum and maximum risk scores are 1 and 25 respectively. Thus a new scoring system is required to convert the various possible risk scores to rankings.

Based on Australian/New Zealand Standard "Risk Management AS/NZ 4360:1999" the following risk matrix has been adopted (refer Table 20.4).

**Table 20.4 – Risk Level Matrix**

		Consequence				
		1	2	3	4	5
Likelihood	5	Moderate	High	Very High	Very High	Very High
	4	Moderate	High	High	Very High	Very High
	3	Moderate	Moderate	High	High	Very High
	2	Low	Moderate	Moderate	High	High
	1	Low	Low	Moderate	Moderate	Moderate

## 21 Risks to High Value Waterways

Using the risk level matrix (shown in Table 20.4), detailed risk assessments were undertaken for all high value waterways\*. These assessments are presented in Appendix I.

The individual risk level matrices informed the identification of remediation and/or protection works for key assets associated with each high value waterway. The resultant actions are presented in Part F.

### 21.1 Risk Summary

To assist in providing an overview of the risks to each of the high value waterways, a

summary table (Table 21.1) has been developed. This summary table was developed by:

1. Identifying assets at risk for each high value waterway (ie if a waterway was considered high value for environmental significance only, then only the risks to environmental assets were scrutinized).
2. Identifying the high and very high risks to these assets (note that this was done for each asset and then ramped up to apply to the entire reach ie if the risk assessment showed a high or very high risk between any threat and asset, then the summary table will show that risk).

\* This risk assessment approach was not undertaken for specific lakes and wetlands where existing risk assessments (eg those within Ramsar Management Plans) were available.

**Table 21.1 – Summary of High and Very High Risks to High Value Waterways in the Corangamite Region**

Landscape Zone	Waterway	Threats															
		Bank	Bed	Fish Barr	Chan Mod	Flow Dev	WQ Tren	WQ Att	WQ Sig	Temp	Alg Blm	Exot Flor	Deg RV	Intr Faun	Loss Hab	Wet Conn	Stck Acc
Aire	Ford River (O26)											High	Very High	High	High	Very High	Very High
	Aire River (O27)	Very High	High				High	High	Very High			Very High	Very High	Very High	Very High	Very High	Very High
	Aire River (O28)						High	Very High						High			
	Elliot River (O54)						High							High			
	Parker River (O55)						High							High		High	
	Aire River Upper (O56)						High	Very High				High					
Bellarine	Barwon River (B1)	High	High		High	Very High	Very High	Very High	Very High		Very High		Very High	High	Very High	Very High	
	Wairn Ponds Creek (B8)		Very High		Very High						Very High		Very High	High	Very High	Very High	Very High
	Swan Bay						High					High		High			
	Lake Connewarre	High				Very High	High					Very High		Very High			High
	Reedy Lake	High				Very High	High					Very High		Very High			High
Curdies	Curdies River (O1)				High		High	Very High	Very High		Very High	High	Very High		Very High	Very High	Very High
	Curdies River (O2)		High		High		High	High	High		Very High		Very High	High	High	Very High	Very High
Gellibrand	Gellibrand River (O12)				Very High	High	High	Very High				Very High	Very High	High	Very High	High	Very High
	Gellibrand River (O13)	High			High	High	Very High	Very High				High	Very High	High	Very High	Very High	Very High
	Gellibrand River (O16)		High		High	High	Very High	Very High				Very High	Very High		Very High		
	Gellibrand R (S Otway) SWSC	High					Very High	Very High	High				Very High				Very High

Landscape Zone	Waterway	Threats															
		Bank	Bed	Fish Barr	Chan Mod	Flow Dev	WQ Tren	WQ Att	WQ Sig	Temp	Alg Blm	Exot Flor	Deg RV	Intr Faun	Loss Hab	Wet Conn	Stck Acc
	Gellibrand River SWSC	High					Very High	Very High	Very High				Very High				Very High
Hovells	Limeburners Bay						High					High		High			
Leigh	Leigh River (B12)		High	High		Very High	High	High	High		Very High	Very High	High	High			Very High
Lismore	Lake Corangamite	High				Very High	Very High					Very High		Very High			High
	Lake Gnarpurt	High				High	Very High										High
	Lake Milangil					High	Very High										High
	Lake Terangpom	High				High	Very High										High
	Cundare Pool/Lake Martin					Very High	Very High										Very High
	Kooraweera Lakes					Very High	Very High										Very High
Mid Barwon	Barwon River (B2)			Very High	Very High	Very High	High	Very High	Very High		Very High	Very High	Very High	Very High	Very High	Very High	Very High
Moorabool	Lal Lal Reservoir SWSC	Very High					Very High	Very High			Very High		Very High				Very High
	Moorabool R - Sheoaks SWSC	High					Very High	Very High	Very High		Very High		Very High				Very High
Murdeduke	Lake Murdeduke	High					Very High										High
Otway Coast	Barham River (O30)	High	High	Very High	Very High		High	High				Very High	Very High	High	Very High	Very High	Very High
	Cumberland River (O32)			Very High			High	Very High				High		High			
	Erskine River (O33)	Very High	Very High	Very High	High		High					Very High	Very High				
	St George (O44)					Very High	High			High		High		High			
	Wye River (O46)	High		Very High			High	High				Very High	Very High	High	High		

Landscape Zone	Waterway	Threats															
		Bank	Bed	Fish Barr	Chan Mod	Flow Dev	WQ Tren	WQ Att	WQ Sig	Temp	Alg Blm	Exot Flor	Deg RV	Intr Faun	Loss Hab	Wet Conn	Stck Acc
	Kennett River (O47)	High					High	High				High		High	High		
	Grey River (O48)						High					High		High			
	Carisbrook Creek (O49)						High					High		High			
	Smythes Creek (O50)						High					High		High			
	Skenes Creek (O51)						High					High		High			Very High
	Wild Dog Creek (O52)	High	Very High									High		High			
	Lorne SWSC						High										
	West Barham River SWSC						High						High				
Stoney Rises	Lake Beeac		High			High	Very High					Very High		Very High			High
	Lake Colongulac	High					Very High										High
	Lake Cundare	Very High															Very High
	Lower Lough Calvert					Very High	Very High										
	Middle Lough Calvert					Very High											Very High
	Upper Lough Calvert					Very High											Very High
Thompson	Anglesea River (O34)	High	High		High		High	High			Very High	High	High		Very High	Very High	
	Thompson Creek (O36)				Very High	High			Very High		Very High		Very High	Very High	High	Very High	Very High
	Painkalac Creek (O42)	High	Very High		High	Very High	Very High	High		Very High		Very High	Very High		High	Very High	Very High
	Painkalac SWSC	High					Very High	High					Very High				

Landscape Zone	Waterway	Threats															
		Bank	Bed	Fish Barr	Chan Mod	Flow Dev	WQ Tren	WQ Att	WQ Sig	Temp	Alg Blm	Exot Flor	Deg RV	Intr Faun	Loss Hab	Wet Conn	Stck Acc
Upper Barwon	Barwon R East Branch (B28)						High		Very High			High				High	
	Upper Barwon SWSC						High	High	Very High		Very High						
	Matthews SWSC						High	High	Very High				High				Very High
	Pennyroyal SWSC						High	High	Very High				High				Very High
	Lake Thurrumbong					Very High	Very High										

Bank – Bank Erosion  
 Bed – Bed Instability  
 Fish Bar – Fish Barrier  
 Chan Mod – Channel Modifications

Flow Dev – Flow Deviation  
 WQ Tren – Water Quality (Trend)  
 WQ Att – Water Quality (Attainment)  
 WQ SIG – Water Quality (SIGNAL)

Temp – Temperature  
 Alg Blm – Algal Bloom  
 Exot Flor – Exotic Flora  
 Deg RV – Degraded Riparian Vegetation

Intr Faun – Introduced Fauna  
 Loss I/Hab – Loss of Instream Habitat  
 Wet Conn – Wetland Connectivity  
 Stock Acc – Stock Access