



## Developing Environmental Flow Recommendations for the Goulburn River

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# Main Points

- Scientific panels
- Objectives of the Goulburn study
- Vision statements – desired future state
- FLOWS methodology
- Potential flow related issues explored
- Recommendations based on flow-ecology relationships and increasing variability in the flow regime
- Complementary management activities
- Ecological and socio-economic risks

# Goulburn Scientific Panel

Terry Hillman (MDFRC)

Ian Rutherford (Melbourne University)

Mike Stewardson (Melbourne University)

Jane Roberts (Consultant Botanist)

David Crook (ARI)

Peter Cottingham (CRCFE)

# Scientific Panels

## Advantages:

- 'Wealth' of experience
- Synergies with interaction between disciplines
- Relatively quick and inexpensive
- Flexible, collate and synthesize information from many sources
- Collaborative decision making
- Provides opportunities for interaction between scientists and managers – effective knowledge exchange
- Can be applied in information poor environment (must acknowledge limitations though).



# Scientific Panels

## Disadvantages:

- Recommendations can be speculative and additional investigations are required to confirm hypotheses and predictions
- Recommendations can be based on limited data – may not always be acknowledged
- Can be constrained by the expertise on the panel, or interpersonal relationships (e.g. collective bias, strong personalities holding sway)
- Relatively small pool of scientists with necessary skills from which to draw
- Usually constrained to ecological issues and perceived as part of a 'green' lobby.

# Goulburn study objectives:

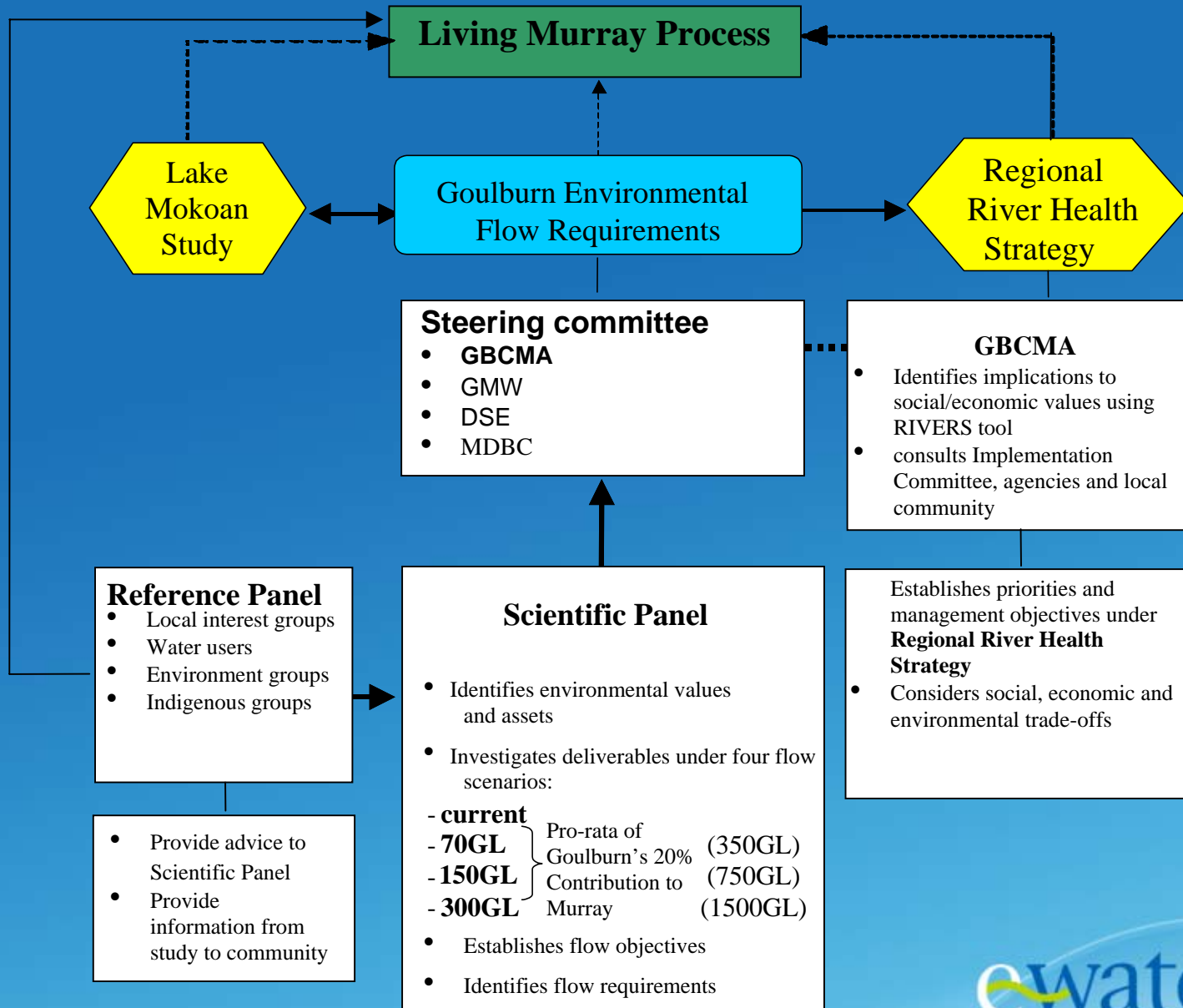
- Identify environmental values and flow objectives for the Goulburn River system consistent the Victorian River Health Strategy and the G-B Regional Strategy;
- Develop environmental flow recommendations suitable for the protection of defined environmental values within the Goulburn River System;
- Identify flow components that can be delivered for the benefit of the Goulburn River when supplying water for the Living Murray Initiative.

## Goulburn Panel vision:

*‘ A healthy working river that supports a diversity of natural ecosystems and processes, thereby sustaining the community of the Goulburn-Broken catchment’.*

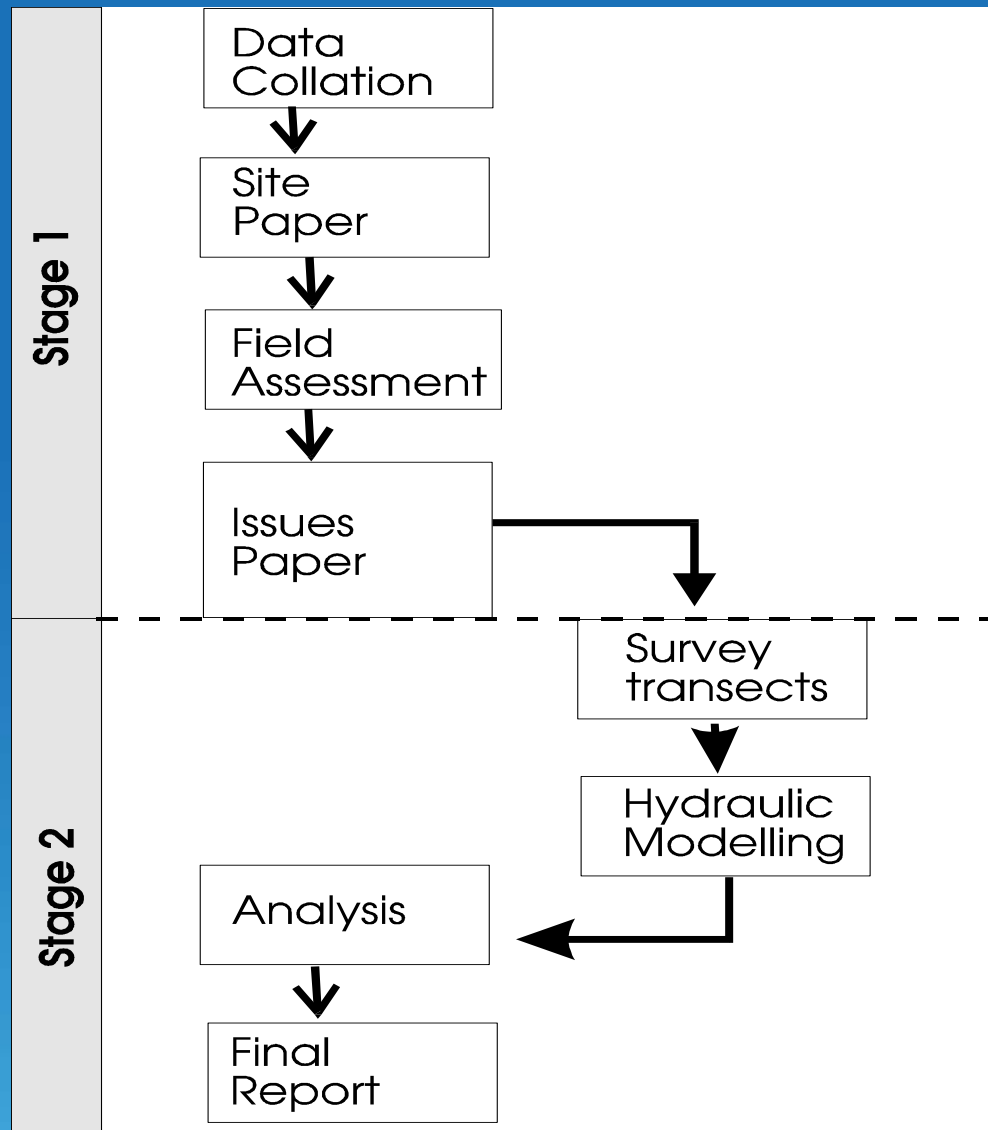
Note: socio-economic aspects were considered in a parallel process led by the Goulburn Broken CMA. Stakeholders were able to assess socio-economic implications of potential flow recommendations and use this to inform the Living Murray Initiative.

## Context of the Goulburn environmental flow project

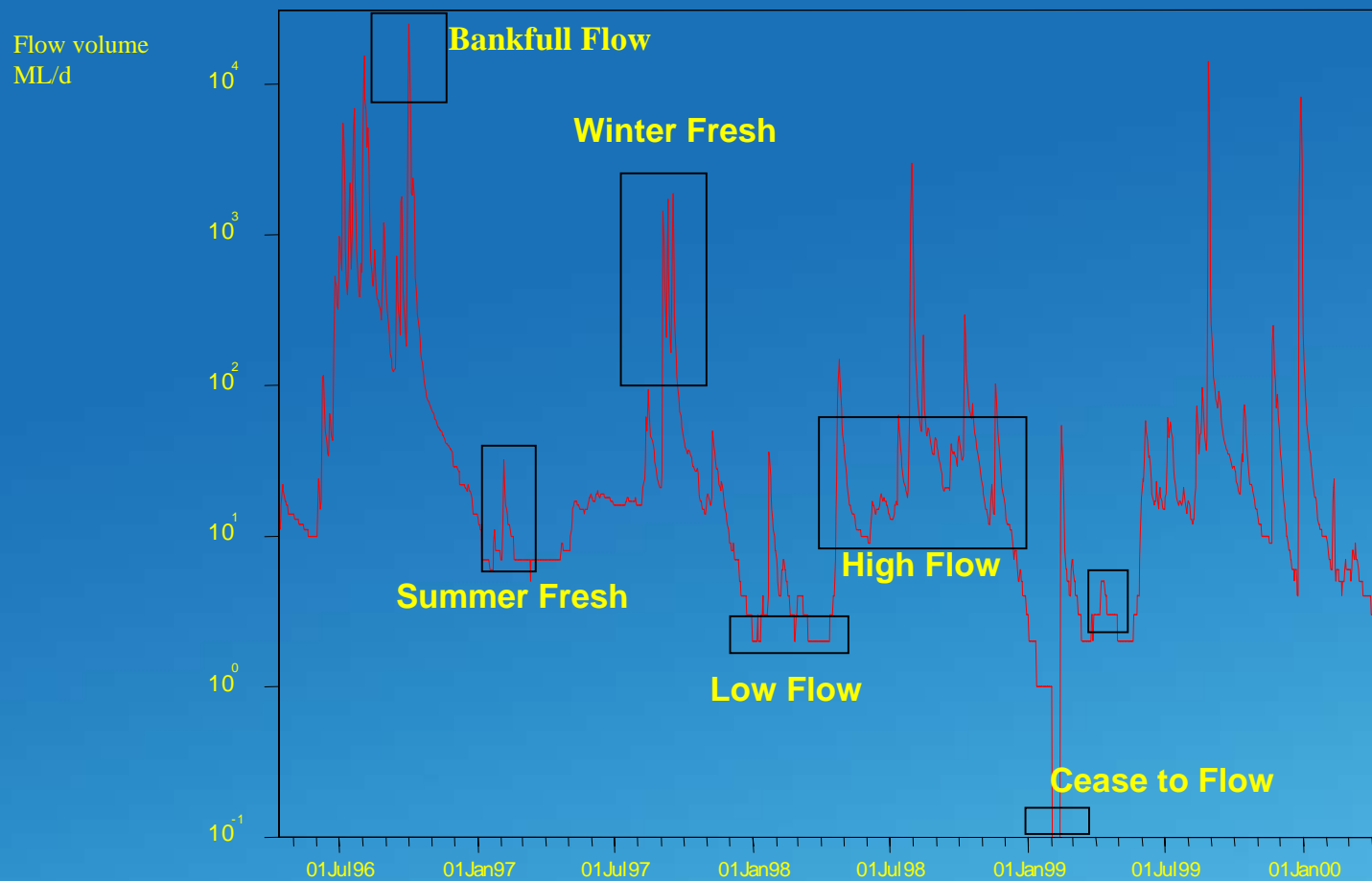




# Victorian FLOWS method – key steps

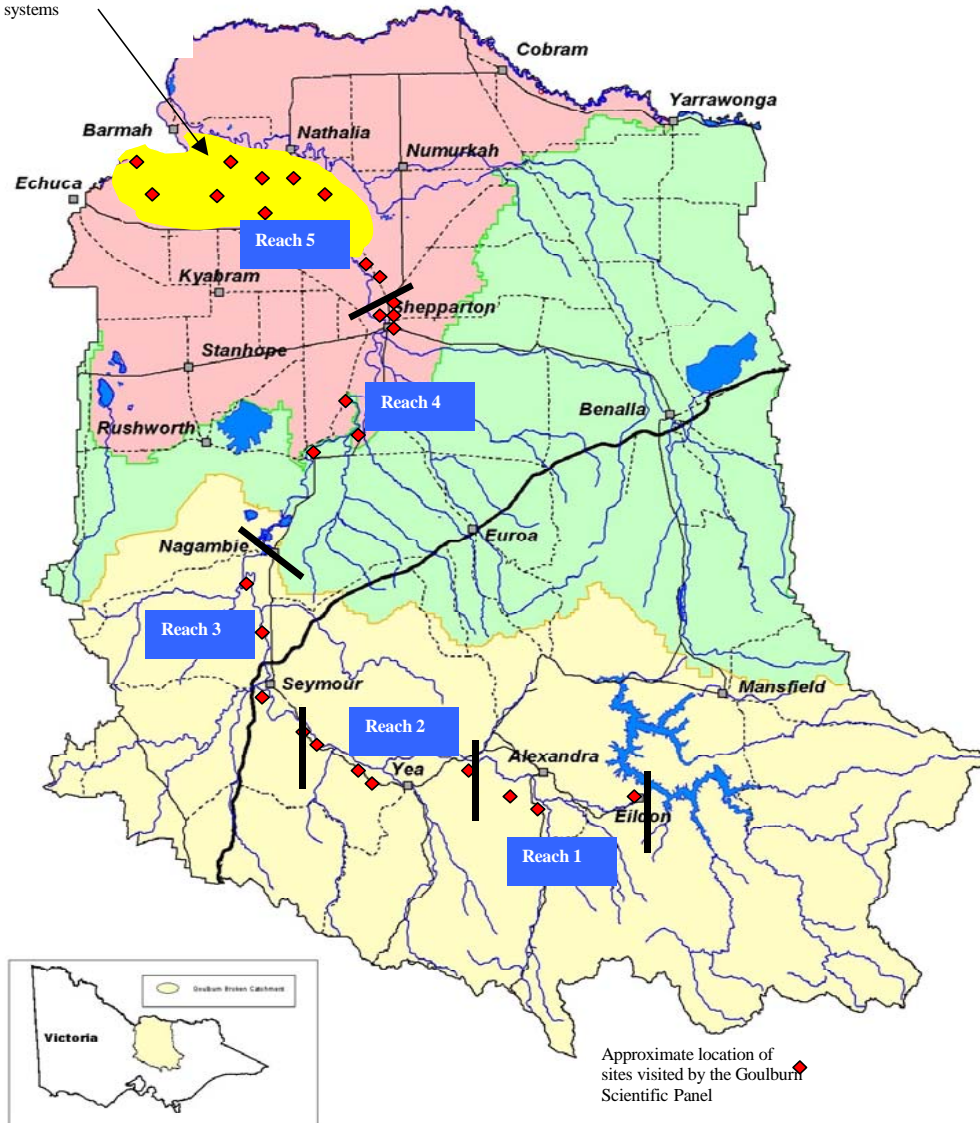


## Daily flow series

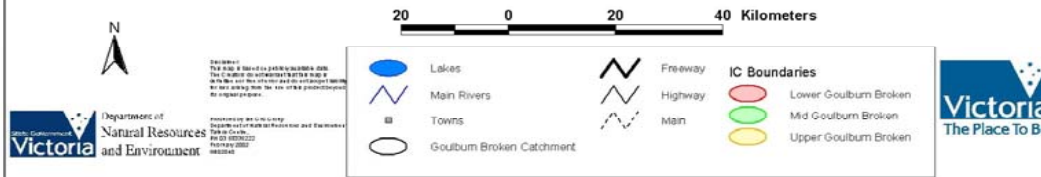


Lower Goulburn floodplain, including Deep and Wakiti Creek systems

# Goulburn Broken Catchment



Approximate location of sites visited by the Goulburn Scientific Panel

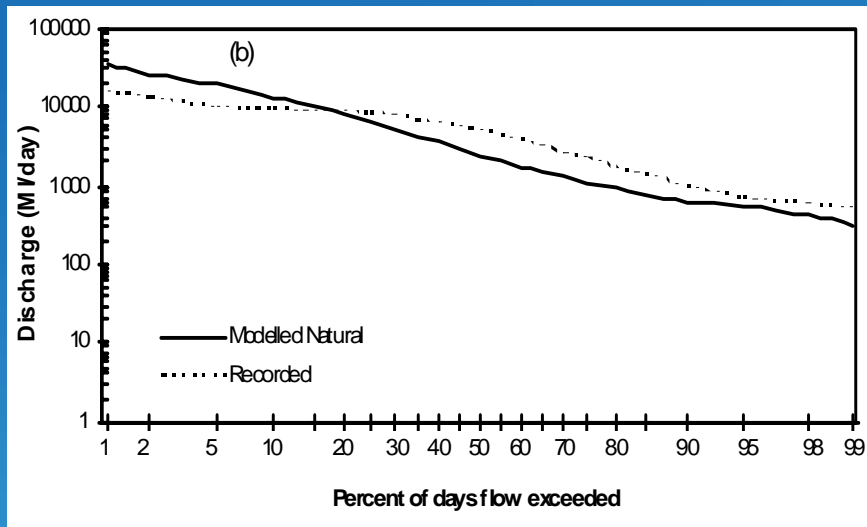
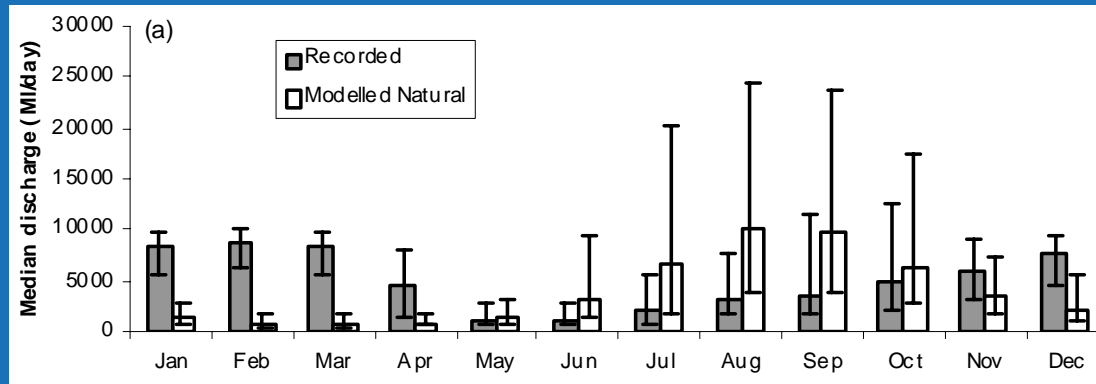


## Flow data and effects of regulation and diversion

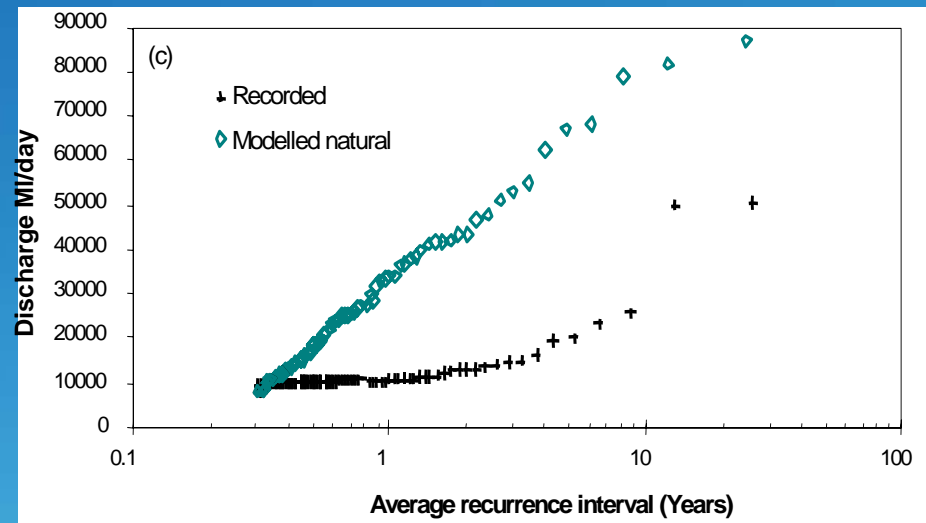
### 1975-2000 (\*\*1984-2000 for Reach 4)

Reach	Current (GL)		Modelled natural (GL)		Difference
	Total	Mean Annual	Total	Mean Annual	
1	48,500	1,940	46,600	1,860	4%
2	57,600	2,300	55,600	2,220	4%
3	62,300	2,500	60,400	2,420	3%
4**	15,500	990	41,800	2,680	-63%
5	37,900	1,510	81,800	3,270	-54%

# Goulburn River at Alexandra



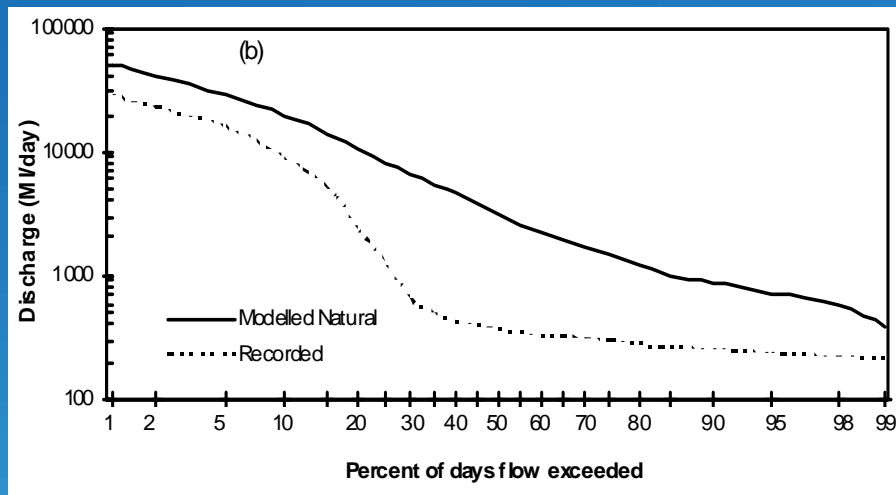
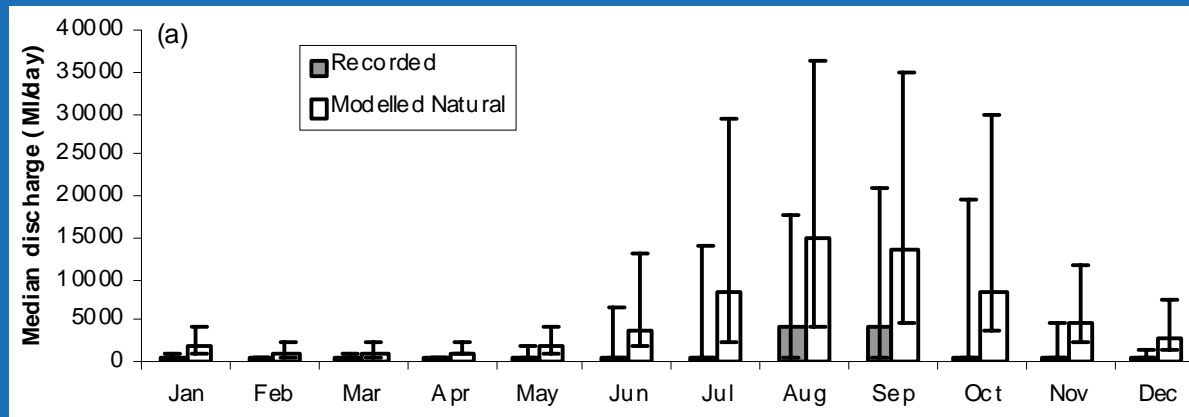
Flow duration



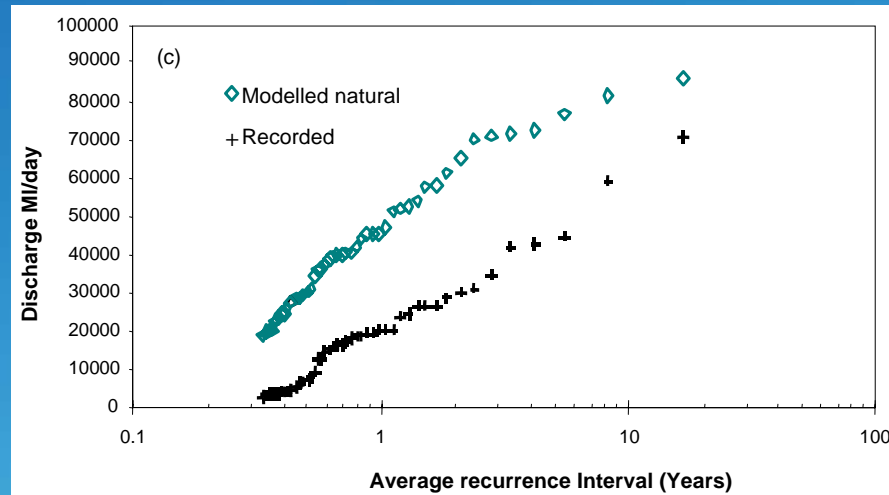
Flood frequency



# Goulburn River at Murchison



Flow duration



Flood frequency





















# Going from visions to reality (recommendations)

Need to make clear links

Desired future state



Flow-related conservation and rehabilitation objectives



Hydrology and hydraulic analyses based on the needs of ecosystem attributes



Recommendations based on predicted ecosystem response

## Potential issues considered

- The infilling of armoured riverbed gravels with fine sediments (Reach 1)
- The seasonal inversion of the flow regime due to high summer-autumn releases (Reaches 1-3)
- Reduced frequency or duration of out-of-channel events that inundate the floodplain and fill wetlands (All reaches);
- Reduced frequency and duration of freshes (Reaches 4 and 5);
- Reduced duration of flows that inundate river benches (Reaches 4 and 5);

## Potential issues considered - continued

- Reduced availability of deep water habitat favoured by fish, particularly native species (Reaches 4 and 5);
- Lows flows (depth less than 0.2m) that prohibit the movement of native fish along the river (all reaches);
- Low summer-autumn flows that can potentially contribute to water stratification and a decline in water quality (Reach 4 and 5);
- Higher rates of rise and fall in flow pulses associated with operation of Lake Eildon and Goulburn Weir that increase the risk of stranding or washout of biota such as invertebrates and fish (all reaches).

## Issues not requiring specific recommendations

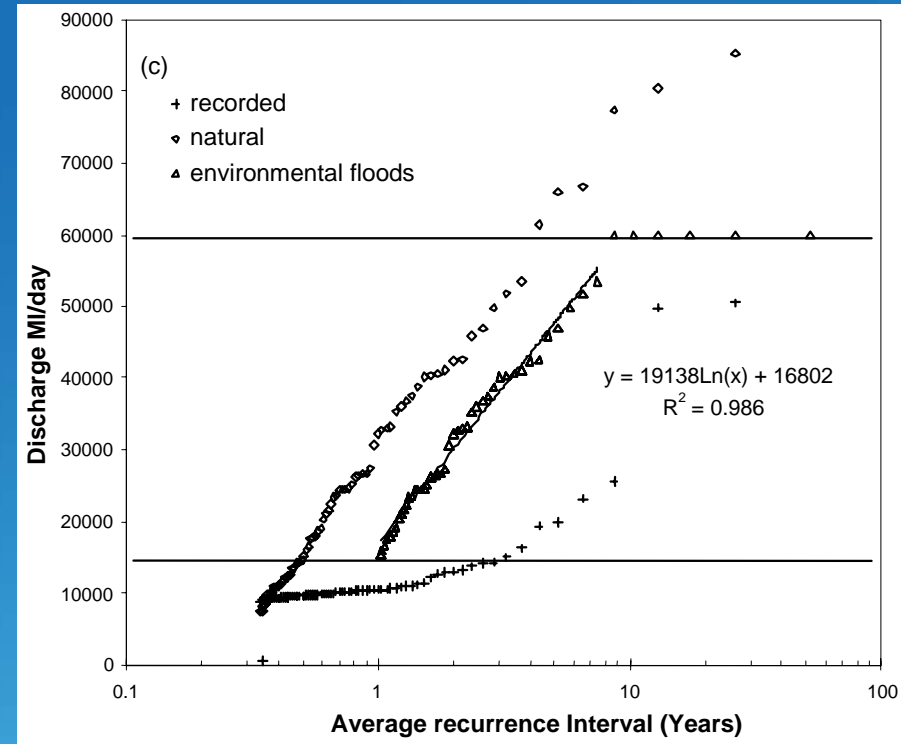
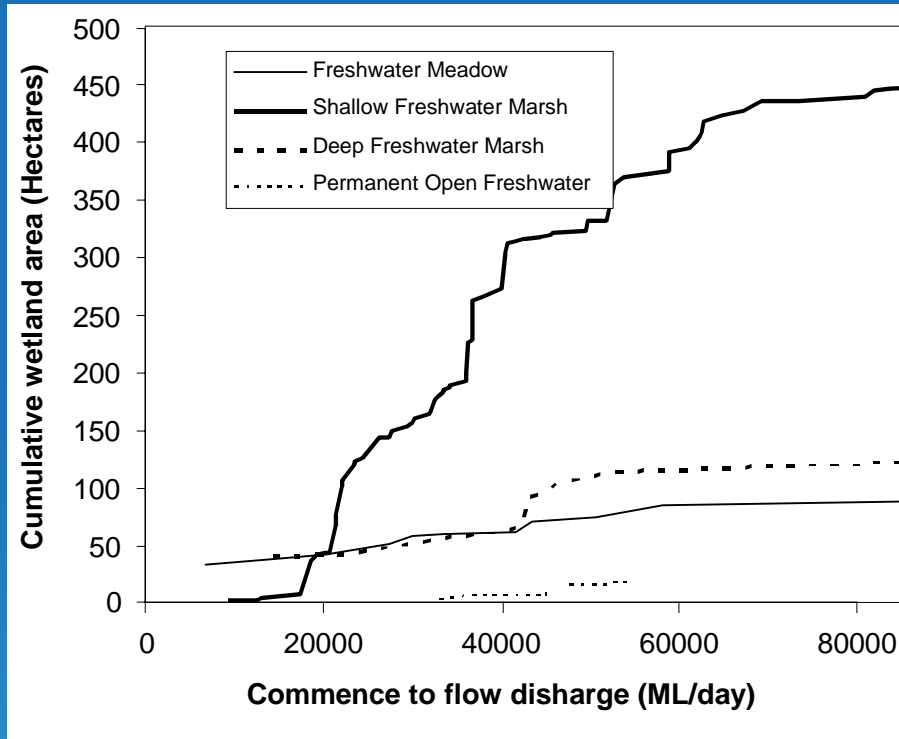
- The infilling of armoured riverbed gravels with fine sediments (Reach 1) (addressed by wetland inundation events)
- Reduced frequency and duration of freshes (Reaches 4 and 5)
- Lows flows (depth less than 0.2m) that prohibit the movement of native fish along the river (all reaches)
- Low summer-autumn flows that can potentially contribute to water stratification and a decline in water quality (Reach 4 and 5)



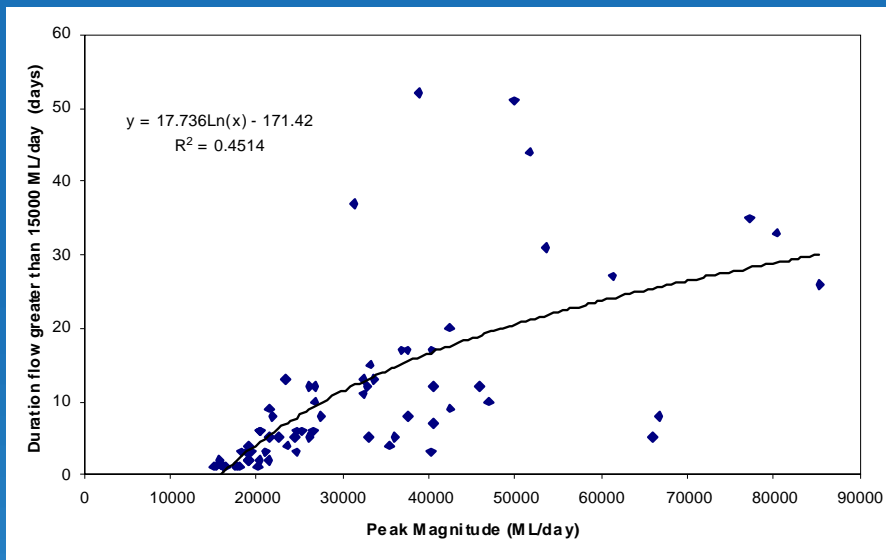
## **Issues requiring environmental flow recommendations**

1. Provision of an annual floodplain/wetland inundation event of varying magnitude (all Reaches);
2. Provision of deep water habitat (minimum flows) for fish in Reaches 4 and 5;
3. Maximum summer-autumn flows (seasonal flow inversion) in Reaches 1-3;
4. Experimental bench inundation in Reach 4;
5. Ensuring rates of rise and fall are within the natural range

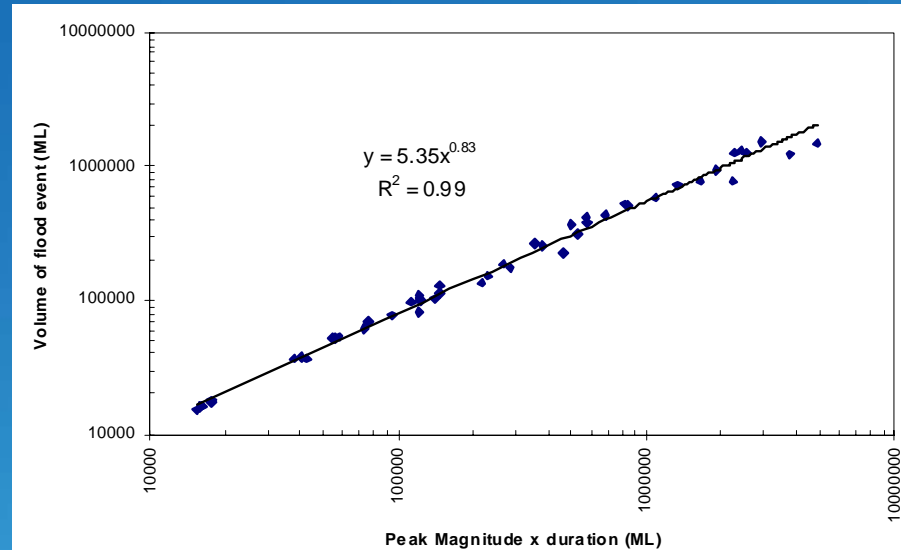
# Wetland inundation in Reach 1



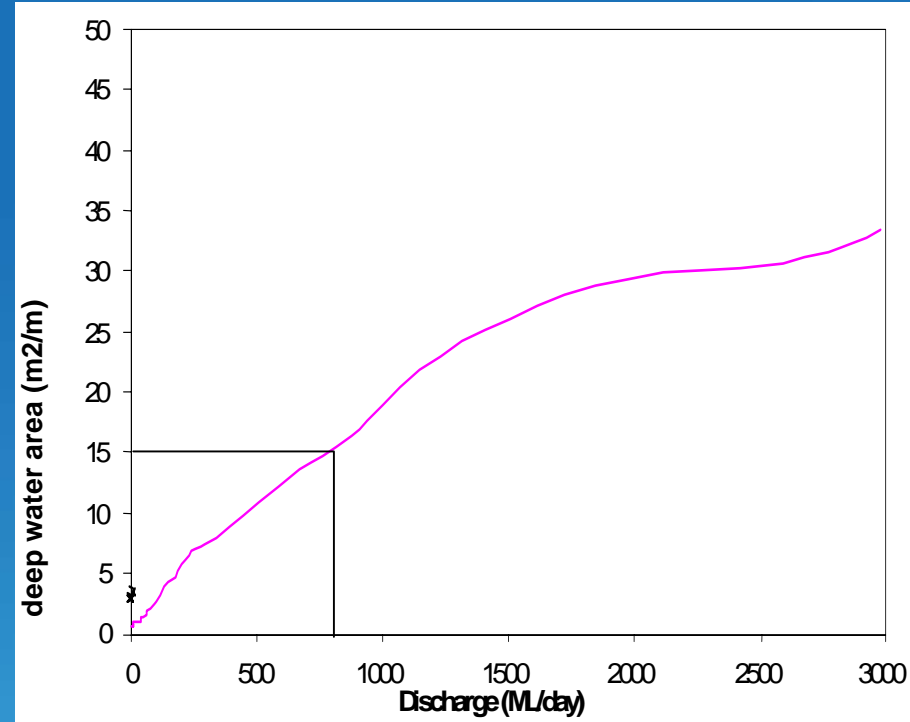
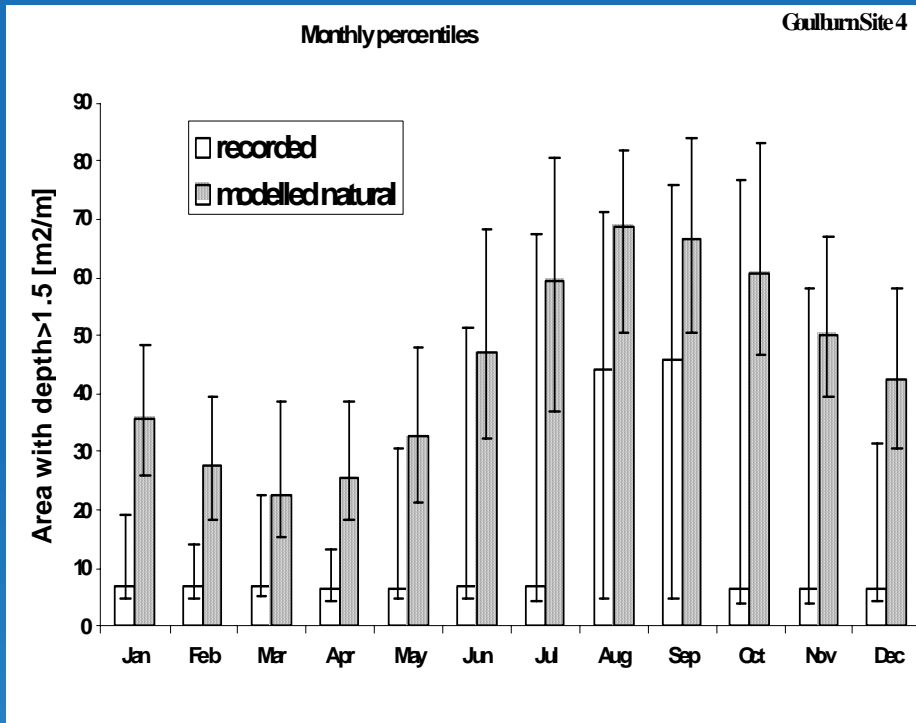
But what duration?



How much water is this?



# Deep water habitat for fish



Recommended a minimum flow in  
Reaches 4 and 5 of 610 ML/d or natural

# Complementary management activities

- Flow is not the only driver of river condition
  - Habitat availability and condition
  - Water quality
  - Land, floodplain and waterway management practices
  - Alien species
  - Weed invasions



## Complementary management activities

- Amelioration of cold water release from Lake Eildon;
- Retention of the ban on gravel extraction from the river;
- Review and removal of unnecessary levees and block banks;
- Provision of fish passage past Goulburn Weir;
- Continued implementation of carp control strategies;
- Control of livestock in the riparian zone and wetlands;
- Continued implementation of water quality, pest control (e.g. weeds and rabbits), revegetation and stream rehabilitation strategies.

## Acknowledge risks associated with flow recommendations

- The implications of changed nutrient, temperature and retention times due to lower summer flows in terms of potential for algal blooms requires further investigation.
- Repeated wetting and drying has the potential for altering nutrient cycling on benches in Reaches 1-3 (e.g. interrupted nitrification-denitrification and P cycling).
- Increased potential for the spread and breeding of carp.
- Potential for increased rates of localised bank erosion from high flows where the riparian zone is in poor condition or where desnagging has left the bank unprotected.

## Acknowledge risks associated with flow recommendations

Socio-economic considerations were not part of this project, but some of the factors that must be evaluated as part of the Living Murray project include:

- Implications of potential reductions in the volumes and security of supply available for water users.
- Risk to private land and infrastructure with increased frequency of floodplain and wetland inundation.
- Reduced recreational opportunities (e.g. if flow regime is less favourable for trout).

## Factors that contributed to the study

- A very capable and well-regarded team (blend of old and new faces) with personalities and experience that are complementary.
- Having an agreed process to follow – adds transparency
- Well considered and balanced Community Reference Panel capable of looking at the system from different perspectives and contributing constructively
- Acceptance by those involved that this project only focused on the environmental perspective – socio-economic perspectives yet to be considered. This was only one part of a much larger jigsaw.

## Factors that contributed to the study

- Access to good quality information from numerous sources (inc hydraulic model)
- Multiple opportunities for the panel to meet to share information, insights and perspectives.
- Tried not to jump to early conclusions about how the current flow regime is affecting river condition and ecological processes.
- Talking to locals with a long memory of the river was very useful. Trick is in achieving a balance between time spent with locals and meeting the needs of the panel.