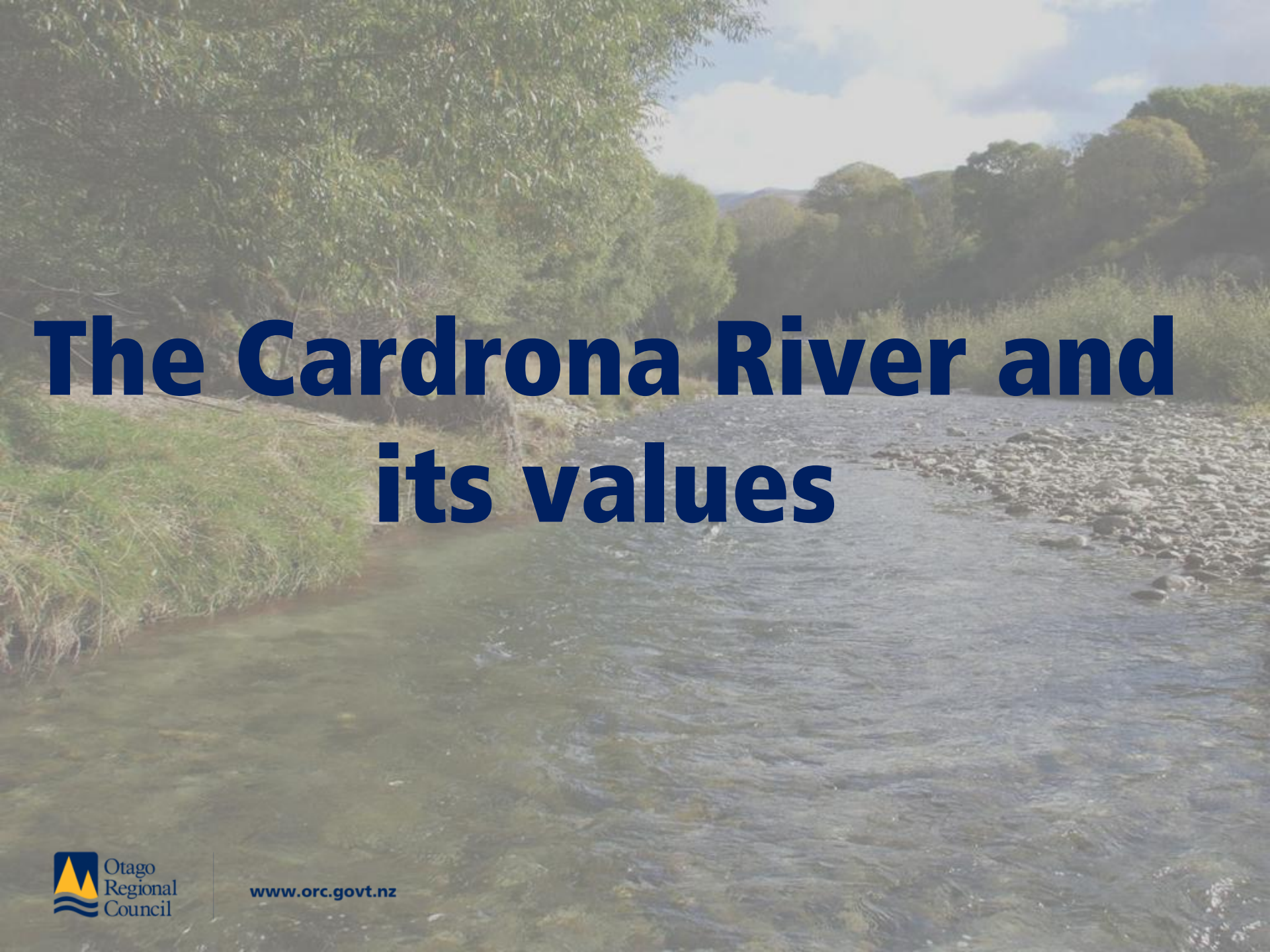

The Cardrona River and its values

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Ecological values in the Cardrona

Native fish

- Koaro
- Upland bully
- Longfin eel
- Clutha flathead galaxias

Sports fish

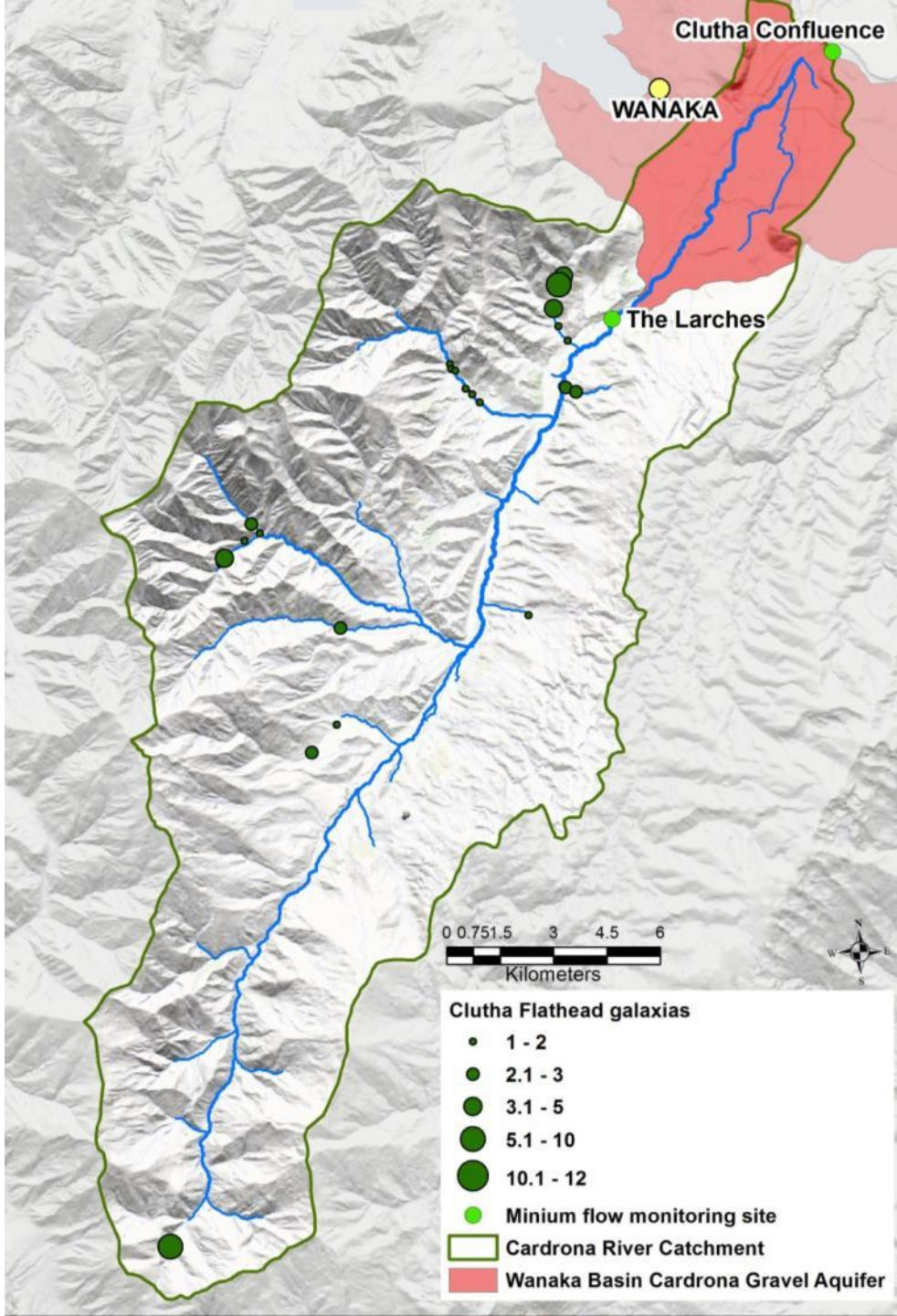
- Rainbow trout
- Brown trout

Socio-economic values in the Cardrona

- Irrigation
- Aesthetics
- Tourism
- Recreation
- 4WDing

Clutha flathead galaxias

- One of the most endangered fish in NZ
- Are only able to exist where trout are absent or in very low numbers
- Are mainly found in small creeks and will not be affected by any minimum flow



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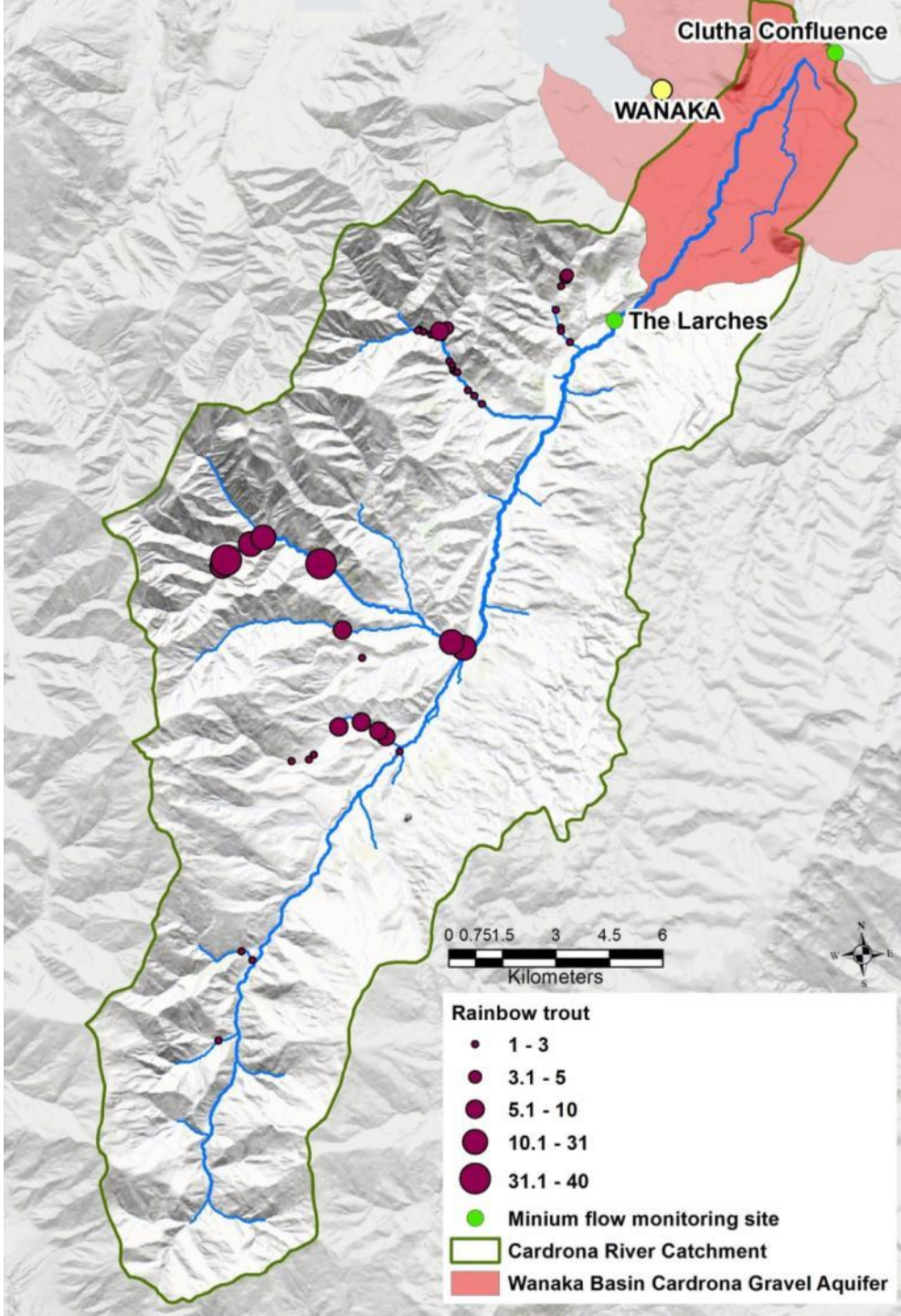
Rainbow trout

- The Cardrona and it tribs provide important spawning areas for the upper Clutha

- Juvenile trout will stay in tribs for as long as possible and then be pushed downstream by floods, so minimum flows will have very little effect on them

- Most adult trout leave the Cardrona by the end of November/early December

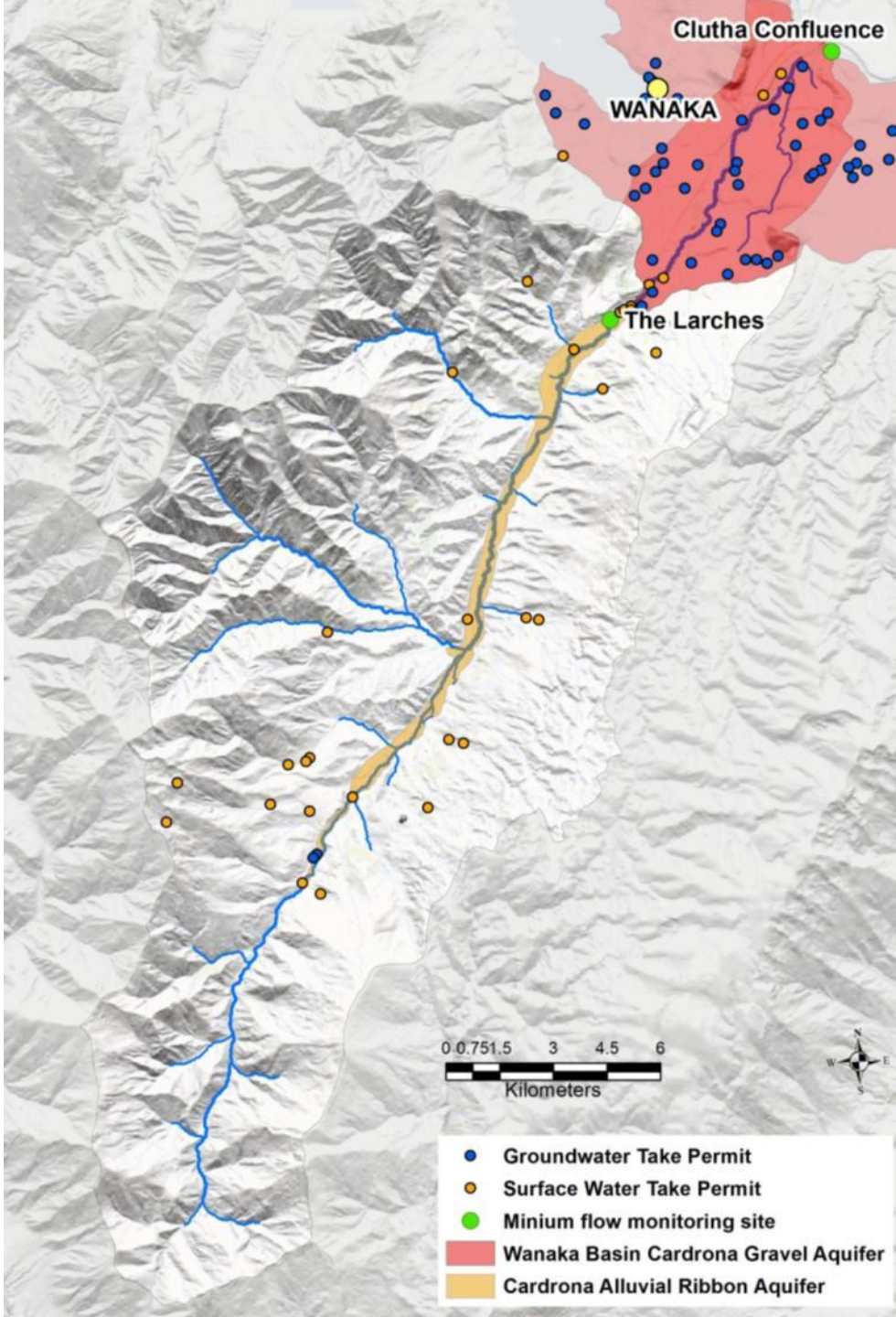


Irrigation

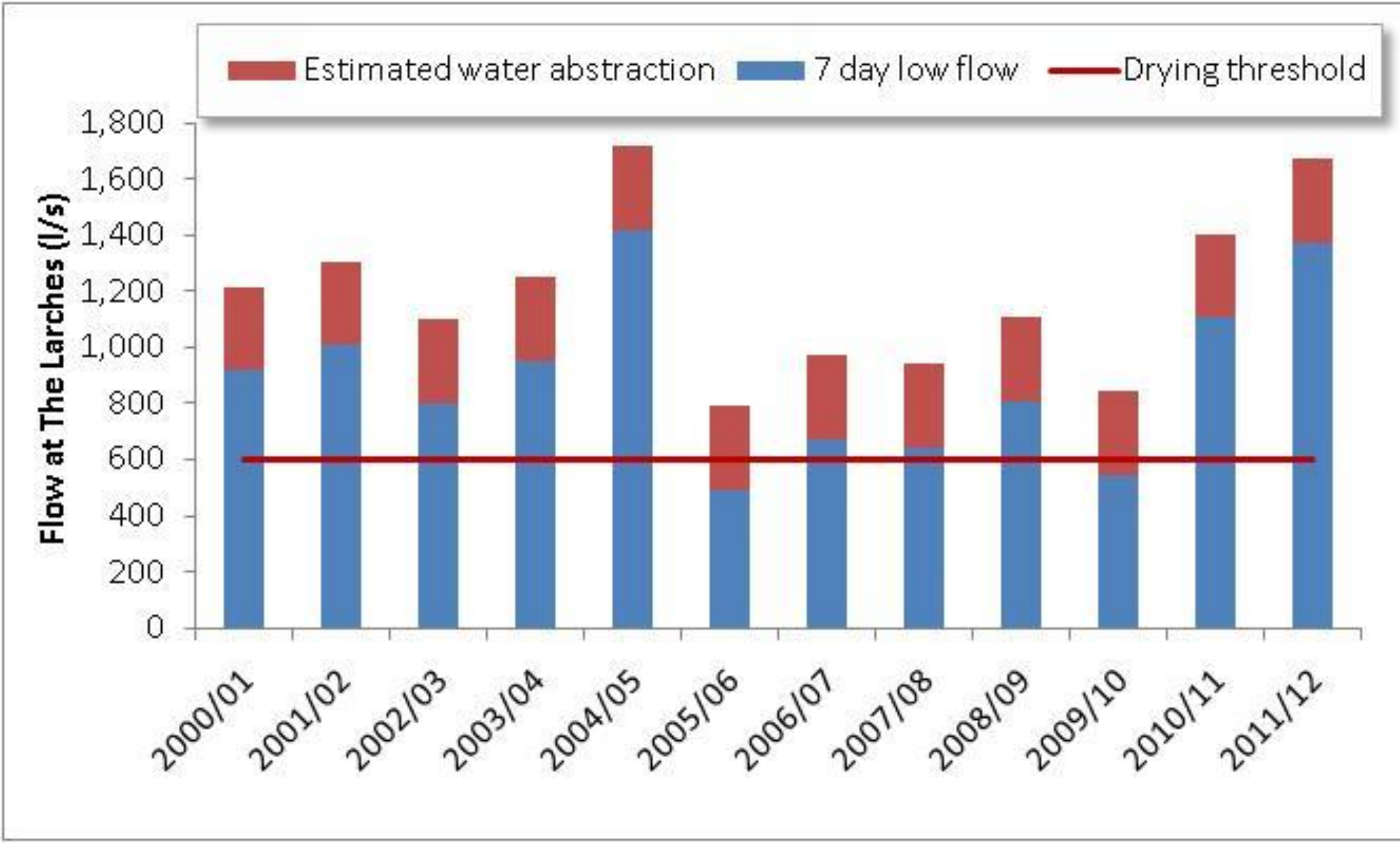
- 2,440 l/s of "paper water" allocated

- Actual peak use 1,160 l/s
  - 620l/s above The Larches
  - 540 below The Larches

- Total use may drop down as low as 600 l/s in dry year



Does the Cardrona naturally run dry?

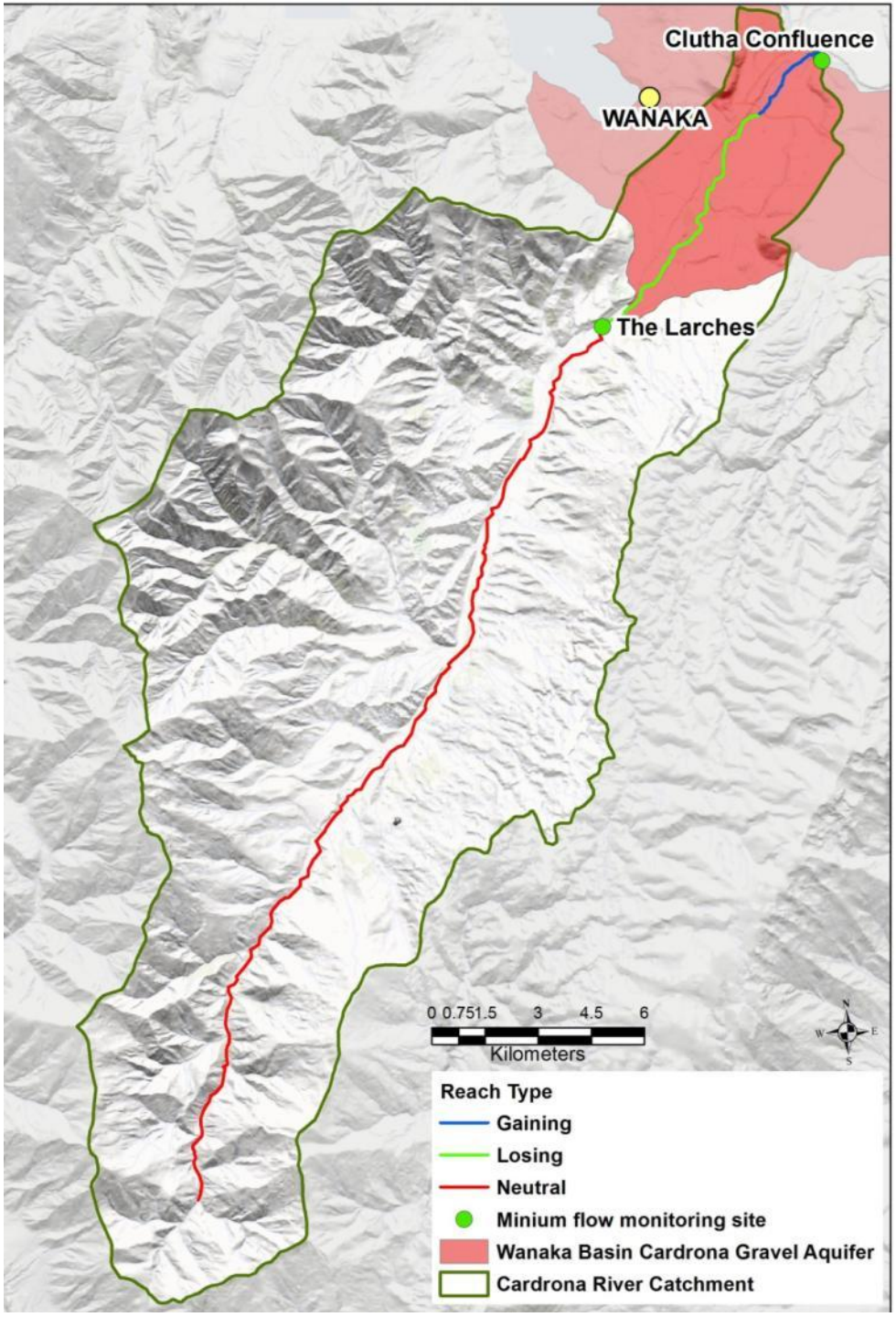


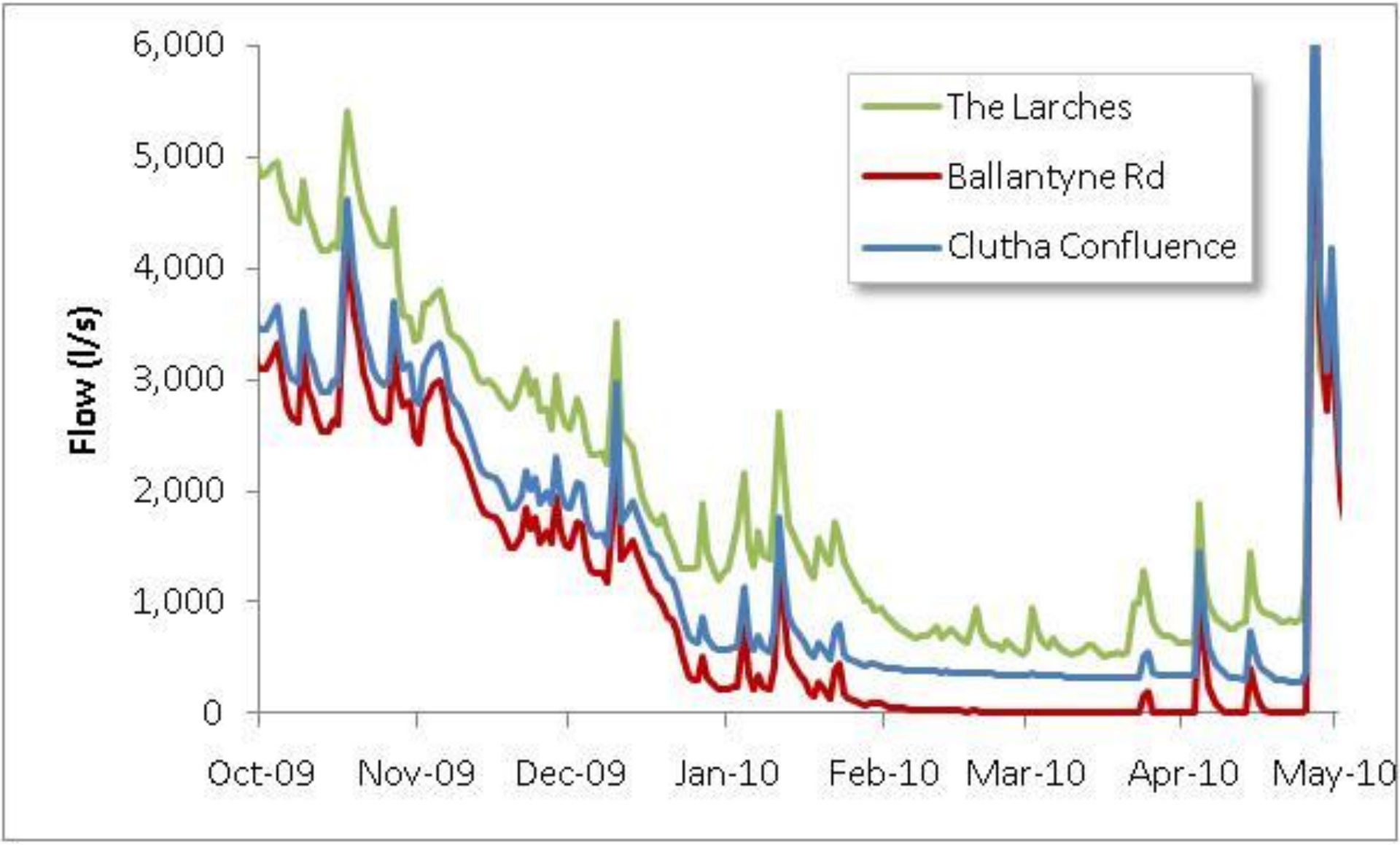
Hydrology of the Cardrona

- Neutral reach – no net loss or gain from groundwater

- Losing reach – up to 600 l/s lost to groundwater

- Gaining reach – 300 l/s gained from groundwater




6,000
5,000
4,000
3,000
2,000
1,000
0
Flow (l/s)
The Larches
Ballantyne Rd
Clutha Confluence
Oct-09
Nov-09
Dec-09
Jan-10
Feb-10
Mar-10
Apr-10
May-10

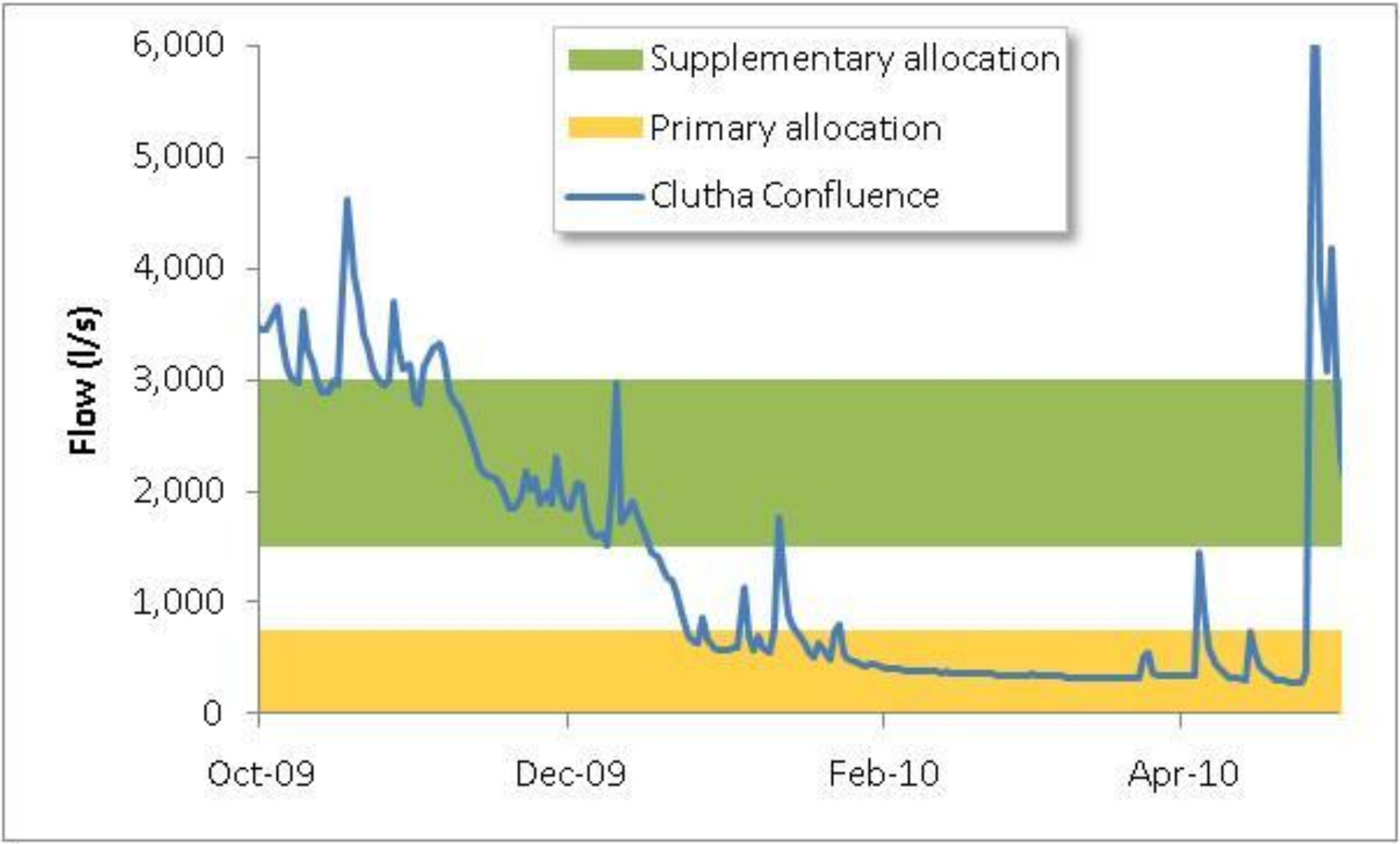
Points to keep in mind

- 400-600 l/s is lost to groundwater below The Larches

- 300 l/s is gained from aquifer downstream of SH6

- If no water is taken, flows at The Larches will be approx 300 l/s more than at the Clutha confluence

Primary and supplementary allocation limits



Primary allocation limit

- The default allocation "target" is 500 l/s
- The current estimated actual take is 1,160 l/s
- We suggest that an allocation limit of between **500 l/s** and **1,000 l/s** is established.
- This will allow current water users to operate while maintaining or increasing surety of supply, but will also encourage efficient water use

Supplementary allocation

- Current supplementary minimum flow is 2,860 l/s (mean flow) at the Clutha confluence

- We suggest the following supplementary allocation regime

Supplementary minimum flow @ Clutha confluence (l/s)	Allocation block size (l/s)
1,500	500
2,000	500
2,500	500
3,000	500

Suggested minimum flow options

- 3 different minimum flow options will be suggested

- Each option is designed to maintain the variety of values put forward by the community in the previous workshops

Option A

"Year round flow continuity"

700 l/s all year at the Clutha confluence

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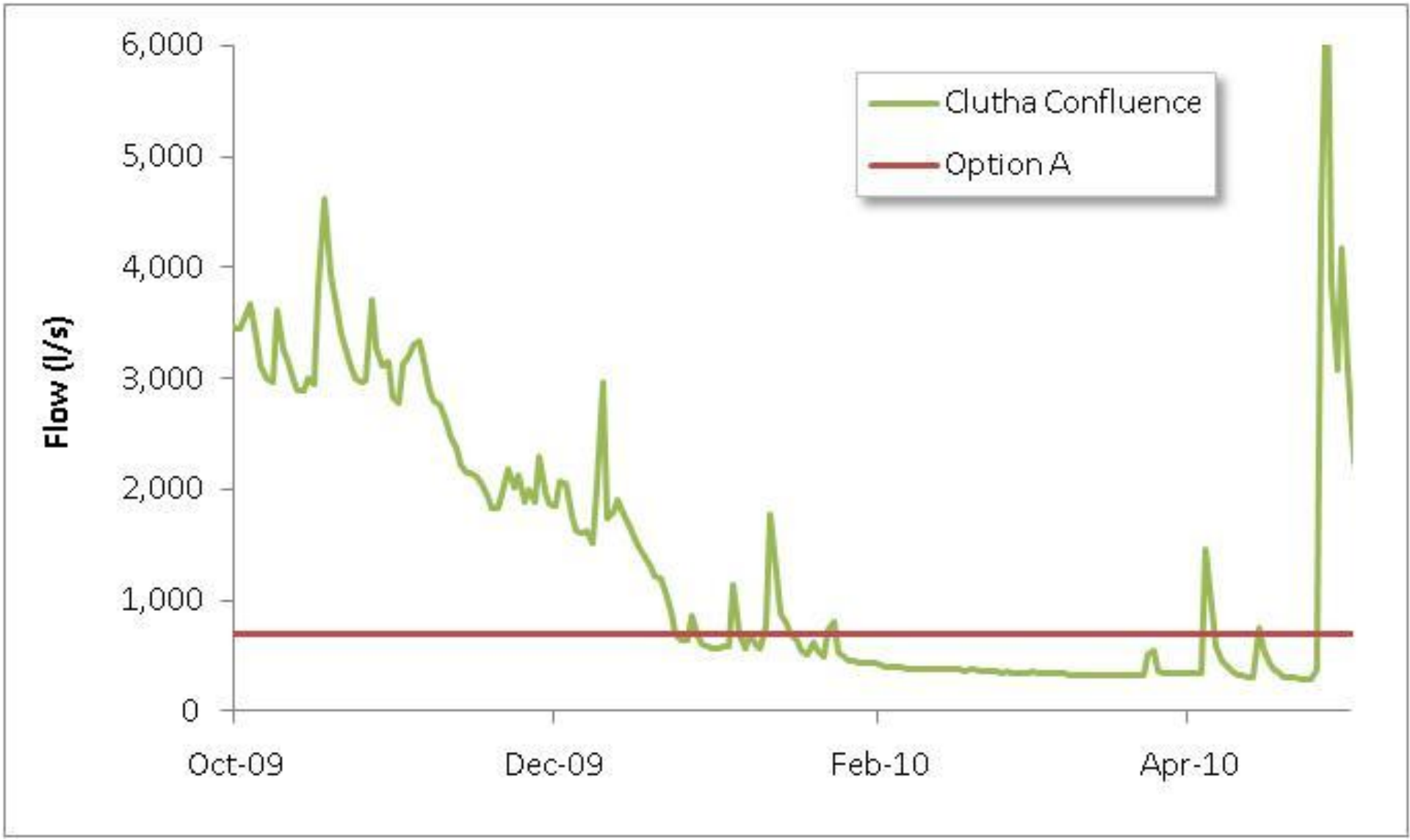
Option A

- Provides year round flow continuity
- Provides flows of approx 1,000 l/s at The Larches (optimum flow for adult and juvenile rainbow trout)
- Provides year round habitat for juvenile trout in the lower reaches of the Cardrona
- Run of the river irrigation will difficult in an average or dry year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4,000
3,000
2,000
1,000
0
Flow (l/s)
Clutha Confluence
Option A
Oct-09
Dec-09
Feb-10
Apr-10

Option B
"Peak holiday season flow"

700 l/s May-Jan
at Clutha confluence

400 l/s Feb-Apr at The Larches

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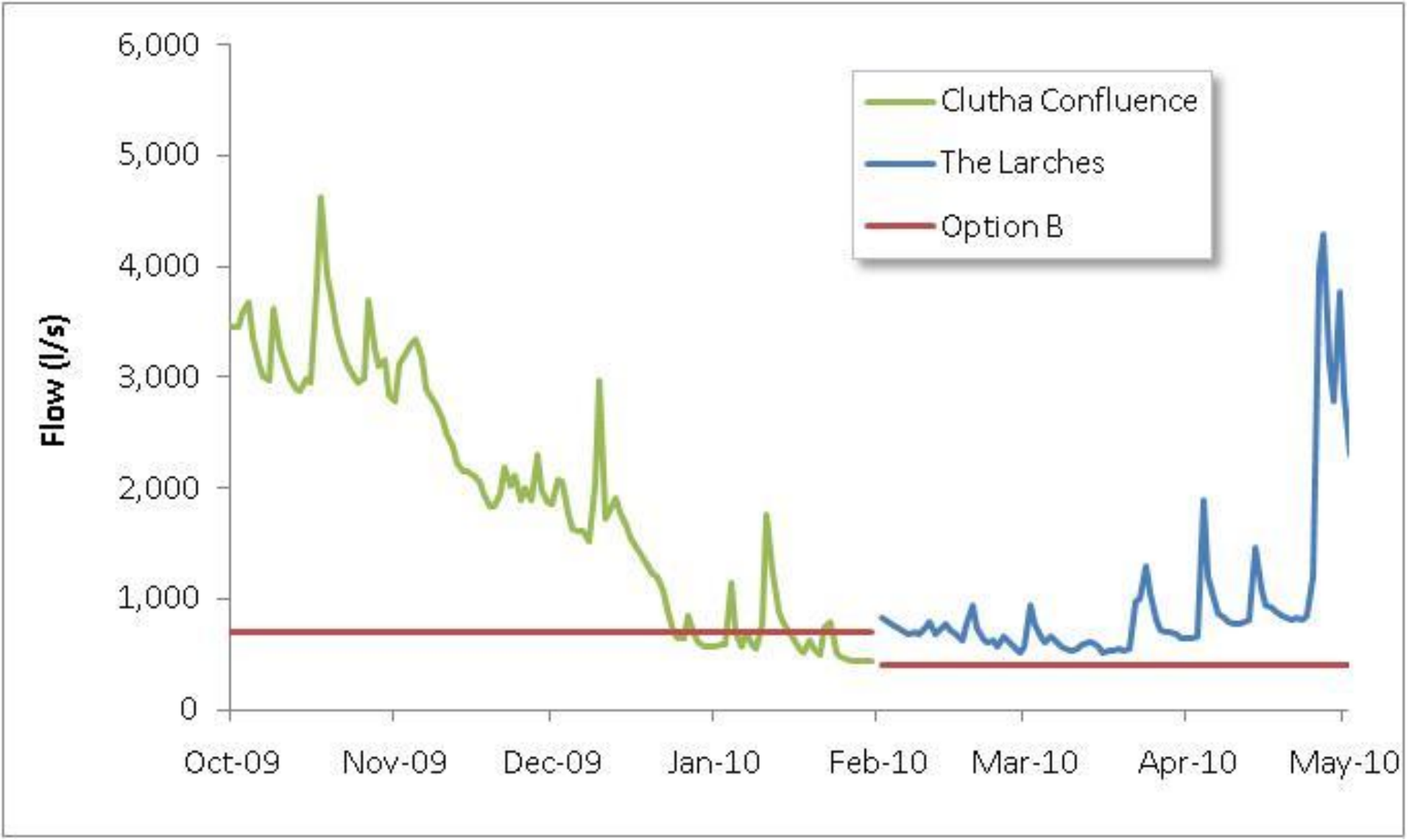
Option B

- May to January (700 l/s at Clutha confluence)
  - Flow continuity from May to January, which includes the peak tourist season
  - Flows of approx 1,000 l/s at The Larches (optimum flow for rainbow trout adult, juvenile & spawning)
  - Allows adult trout to return to the Clutha
  - Moderate irrigation restriction in January

Option B

- Feb to April (400 l/s at The Larches)
  - Allows for irrigation to occur during the driest part of the year
  - Does not provide flow continuity during this period
  - Distributes water resources between "upper" and "lower" water takes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1,000
0
Flow (l/s)
Clutha Confluence
The Larches
Option B
Oct-09
Nov-09
Dec-09
Jan-10
Feb-10
Mar-10
Apr-10
May-10

Option C
"Extended low flow"

700 l/s May-Dec at Clutha confluence

400 l/s Jan-Apr at The Larches

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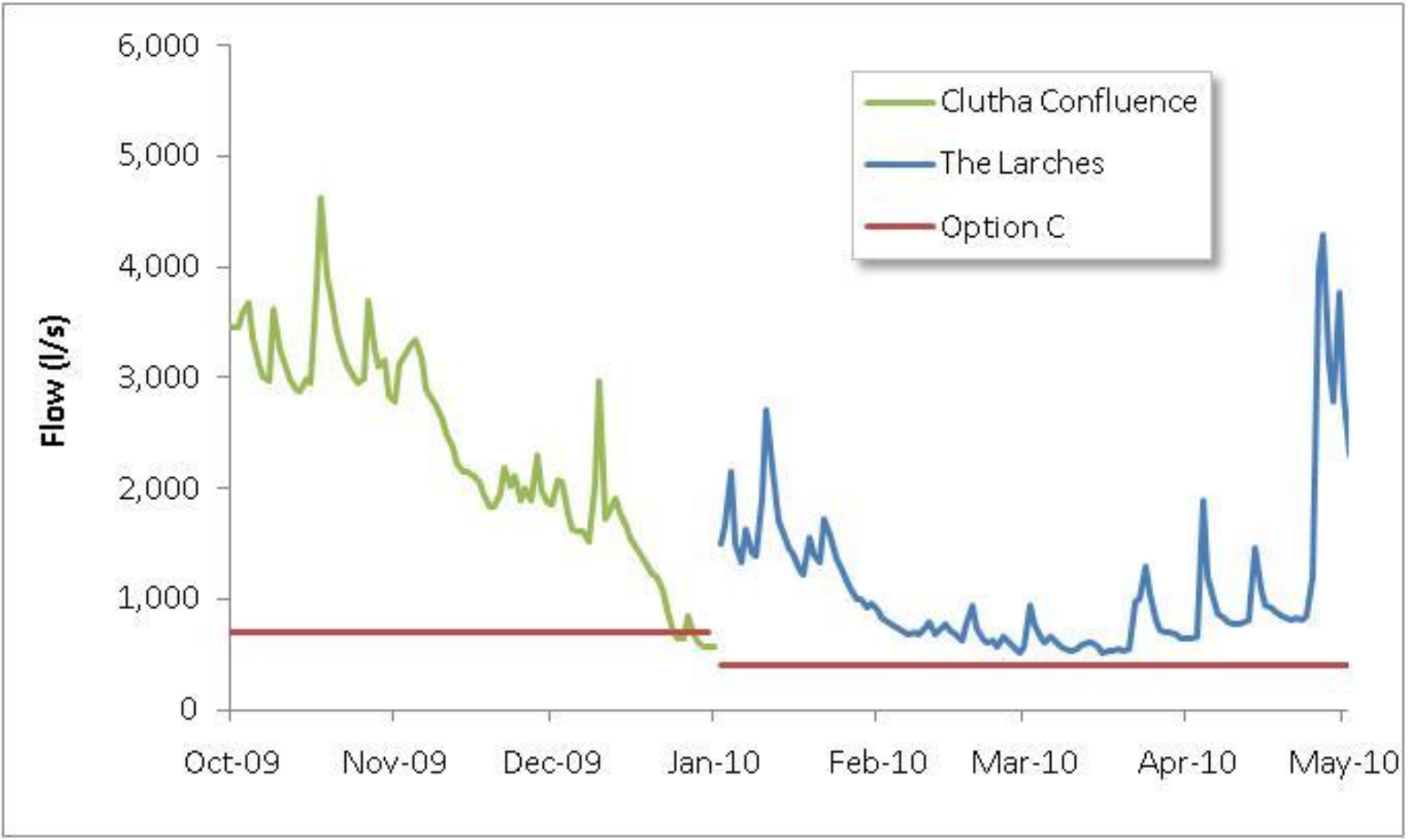
Option C

- May to Dec (700 l/s at Clutha confluence)
  - Flow continuity from May to December, which is similar to current flow regime
  - Flows of approx 1,000 l/s at The Larches (optimum flow for rainbow trout adult, juvenile & spawning)
  - Allows adult trout to return to the Clutha in Nov/Dec
  - Very little irrigation restriction

Option C

- Jan to April (400 l/s at The Larches)
  - Provides *status quo* for current irrigation practice
  - Does not provide flow continuity during this period
  - Distributes water resources between "upper" and "lower" water takes


6,000
5,000
4,000
3,000
2,000
1,000
0
Flow (l/s)
Clutha Confluence
The Larches
Option C
Oct-09
Nov-09
Dec-09
Jan-10
Feb-10
Mar-10
Apr-10
May-10

Effects of minimum flow options on irrigation

		Restriction days per irrigation season	
		2009/10	Average
Option A	700 l/s all year (@ confluence)	109	94
Option B	700 l/s May-Jan (@ confluence), 400 l/s Feb -Apr (@ The Larches)	28	27
Option C	700 l/s May -Dec (@ confluence), 400 l/s Jan-Apr (@ The Larches)	7	9.6