Water abstractions and their effects on river flows

Dan Clark
Senior Hydrological Scientist

Environment Canterbury Regional Council
Kaunihera Taiao ki Waitaha

Overview

- Hydrology background
  - High and low flows
- Abstraction
  - Surface water and groundwater
- Orari case study

Environment Canterbury
Regional Council
Kaunihera Taiao ki Waitaha

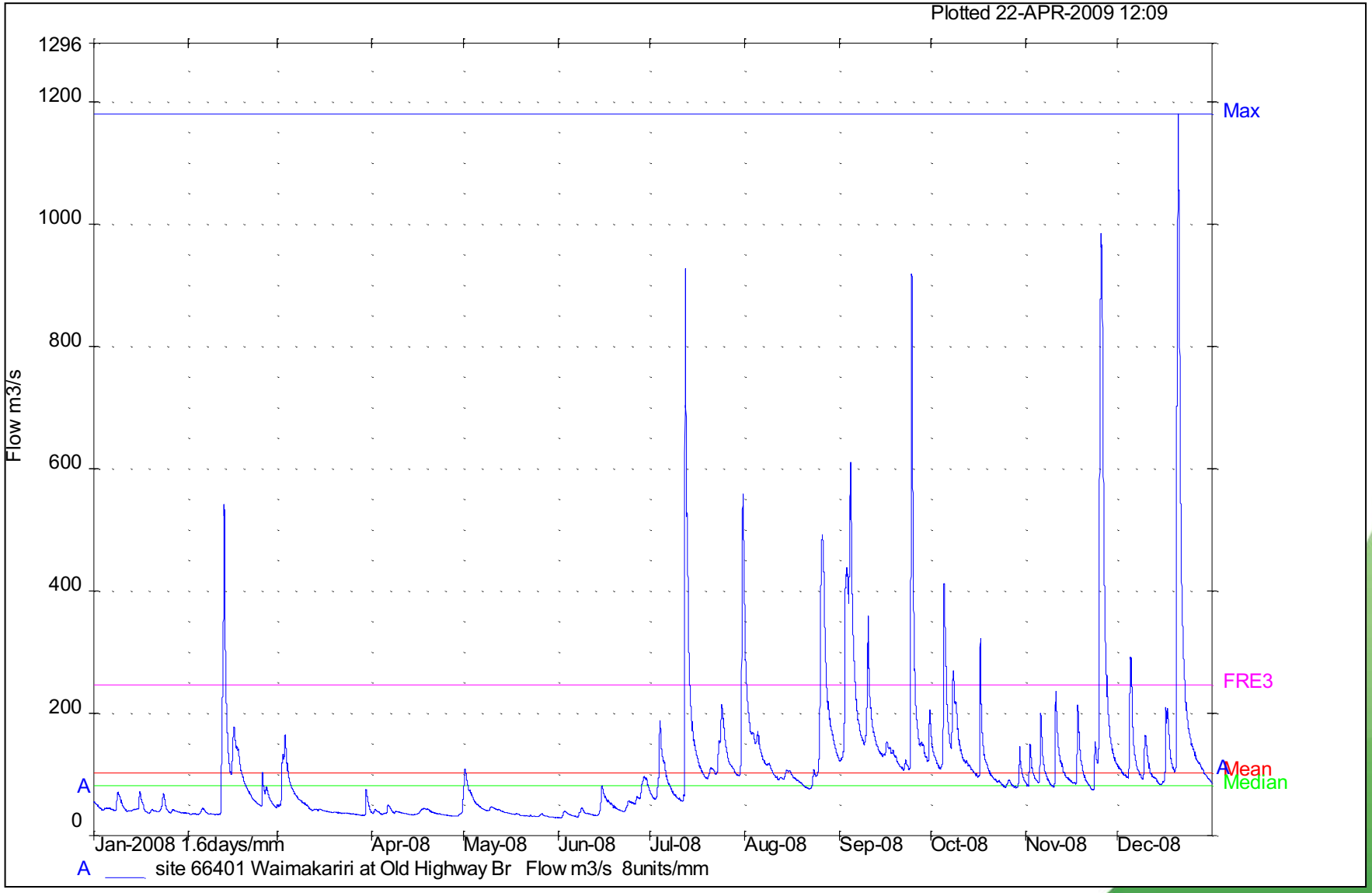
Orari River 1986

onment
erbury
al Council
Taiao ki Waitaha

High flows

- Max Flow
  - Maximum recorded flow
- Mean Flow
  - Average flow for a period
- Median Flow
  - Flow where half flow is above and half below
- FRE3 – (3 x median flow)
  - Figure of ecological importance, the number of times that river flows reach this level is important when looking at the flow regime.

Environment Canterbury
Regional Council
Kaunihera Taiao ki Waitaha



Environment Canterbury Regional Council
Kaunihera Taiao ki Waitaha

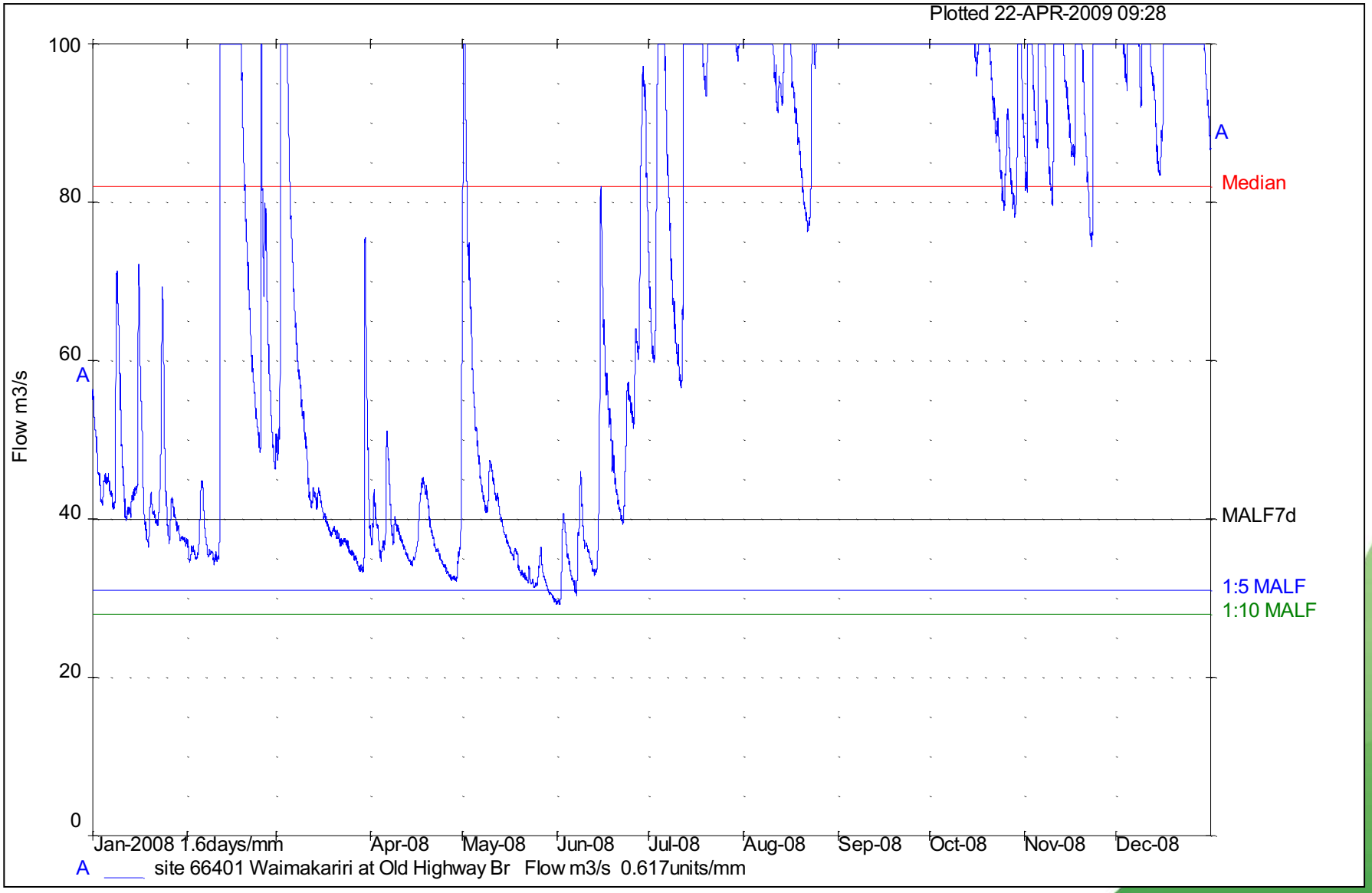
Orari River

Environment Canterbury
Regional Council
Kaunihera Taiao ki Waitaha

Low flows

- ALF (Annual Low Flow)
  - Minimum flow recorded at a site in a year
- MALF (Mean Annual Low Flow)
  - Average of minimum flows over a period of years
- MALF(7d)
  - Long term average flow of 7 lowest consecutive days that occur in each year
  - MALF(7d) will be higher than MALF
  - 7 day duration chosen to remove anomalies
  - 90% 7dMALF often used as environmental minimum

Environment Canterbury
Regional Council
Kaunihera Taiao ki Waitaha



Environment Canterbury Regional Council
Kaunihera Taiao ki Waitaha

Minimum flows and allocation

- Minimum flow = Trigger flow at which abstraction must cease

- Allocation = Amount of water which may be taken from the river or groundwater by consent holders

Environment Canterbury
Regional Council
Kaunihera Taiao ki Waitaha

Surface water abstraction

The effects of surface water abstractions vary depending on the minimum flow set and the size of the allocation granted

Environment Canterbury
Regional Council
Kaunihera Taiao ki Waitaha

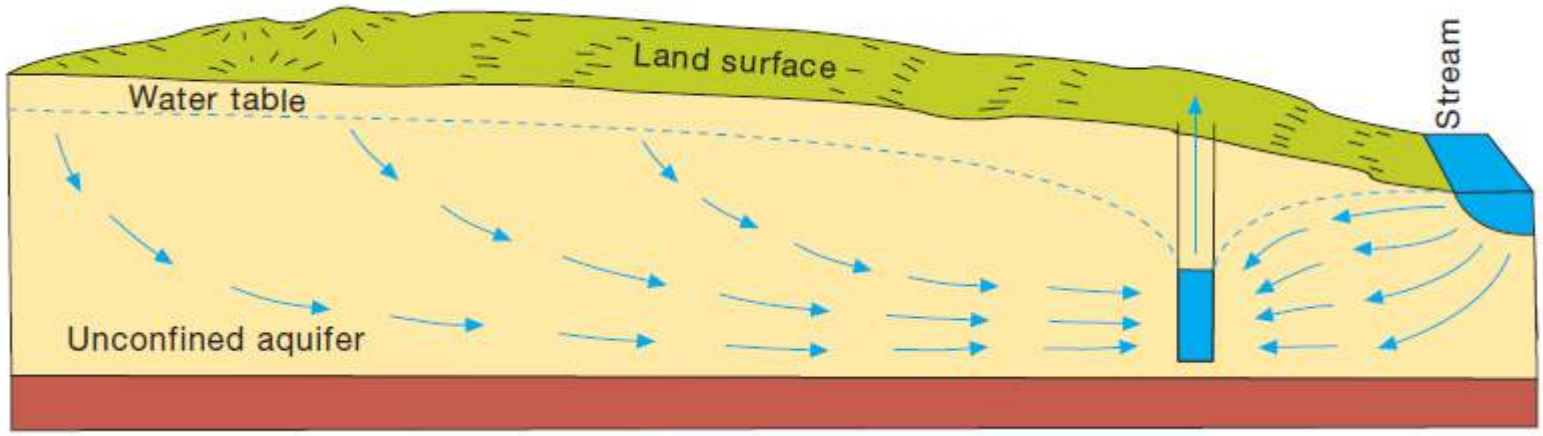
A and B allocations

A block	B block
Lowest minimum flow	Higher minimum flow
Most reliable water	Lower reliability
Run of river takes	Often takes to storage
Affects lower river flows, eg MALF7d, length of dry reaches, duration of low flows	Affects higher river flows, eg freshes, flushing flows

Environment Canterbury
Regional Council
Kaunihera Taiao ki Waitaha

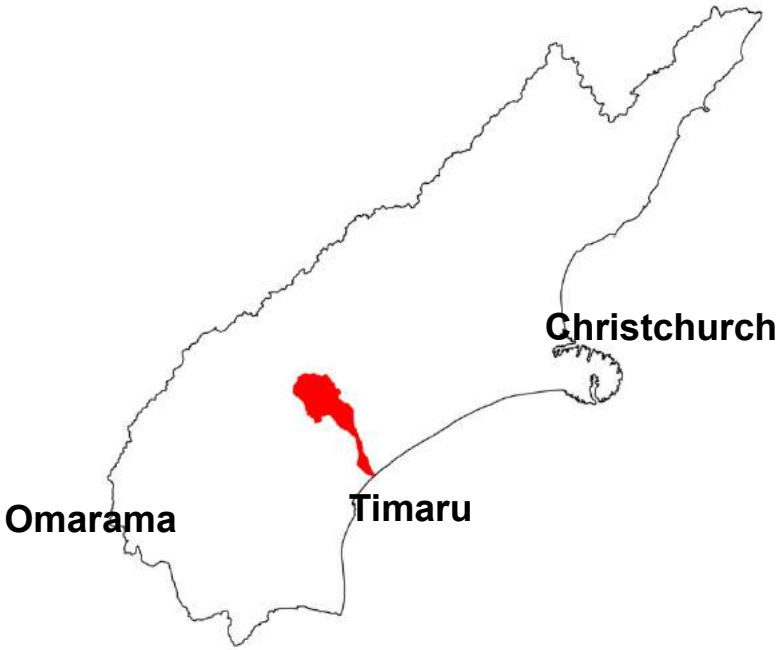
Groundwater abstraction

- Effect of groundwater pumping on stream flow is dependant on proximity of stream, rate and aquifer properties
- This is described as stream depletion



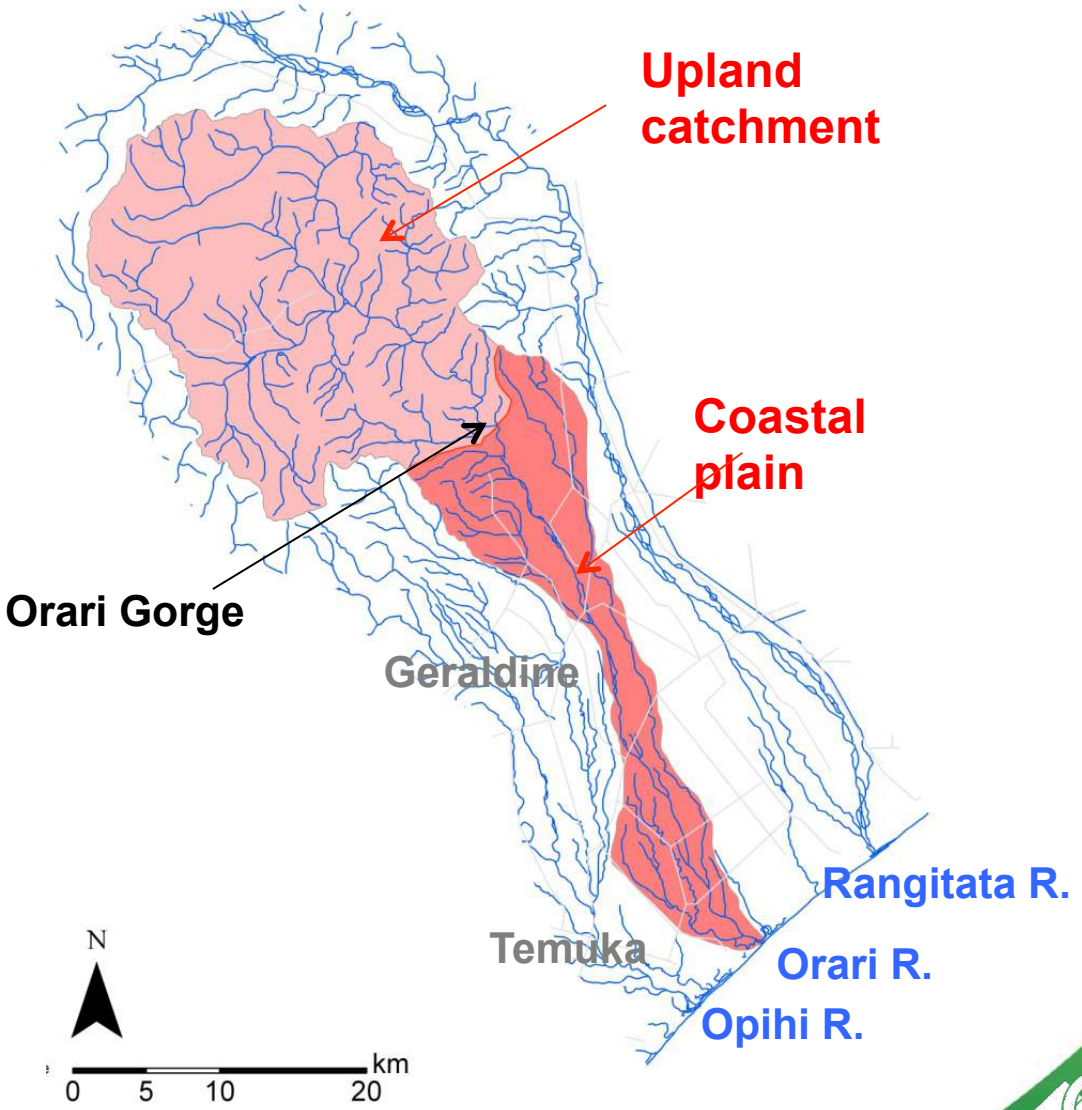
ment
ury
ouncil
Kaunihera Taiao ki Waitaha

Orari River case study



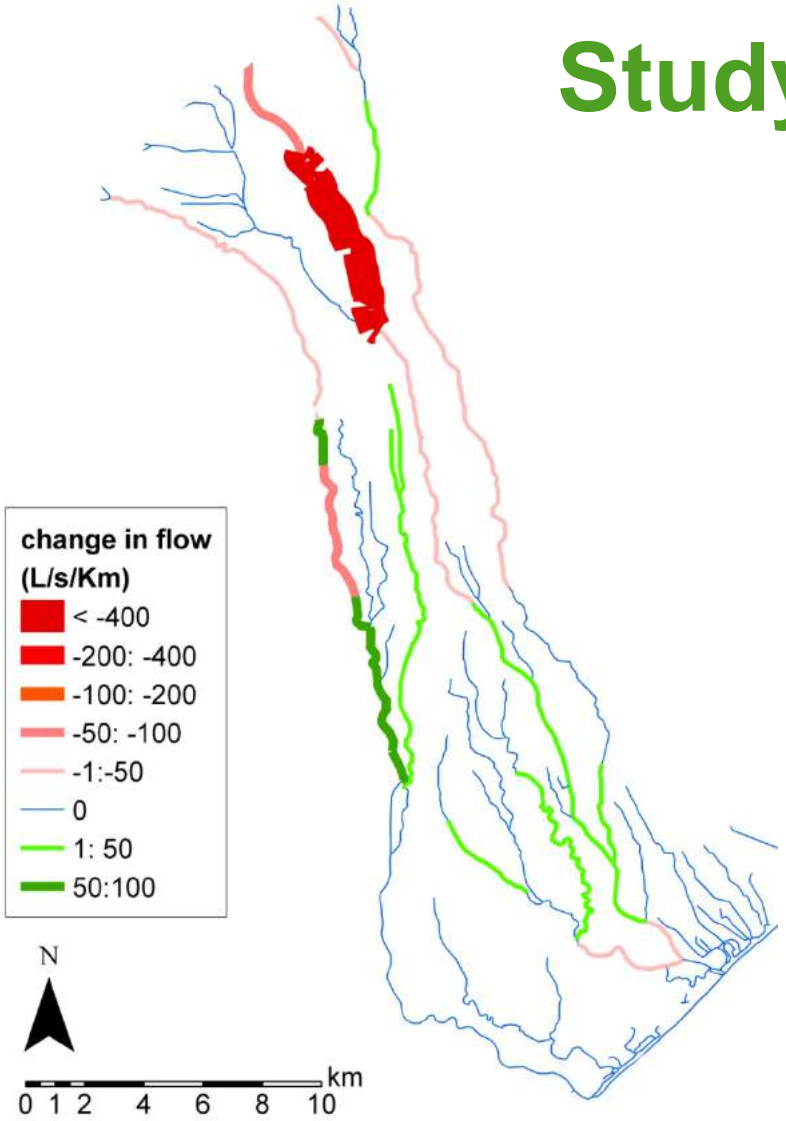
2010 study by Burbery and Ritson to investigate the surface water and groundwater resource

Environment Canterbury
Regional Council
Kaunihera Taiao ki Waitaha



Environment Canterbury
Regional Council
Kaunihera Taiao ki Waitaha

Study findings



- Mapped losses and gains
- Limited groundwater storage within the system

Environment Canterbury
Regional Council
Kaunihera Taiao ki Waitaha

How the study was used

- Orari flow plan
  - Includes the stream depleting component of groundwater in surface allocation
  - Minimum flows to control stream depleters
  - Conjunctive use zone

Environment Canterbury Regional Council
Kaunihera Taiao ki Waitaha

Acknowledgements

- Lee Burbury (ESR)
- Jen Dodson (Ecan)

Environment Canterbury
Regional Council
Kaunihera Taiao ki Waitaha