Canterbury Water Management Strategy
OTOP Infrastructure Modelling

Mō tātou, ā, mō kā uri a muri ake nei
For us and our children after us

November 2016

Environment Canterbury
Regional Council
Kaunihera Taiao ki Waitaha

Orari-Opihi-Pareora ZIP R3.2.1 (2012)

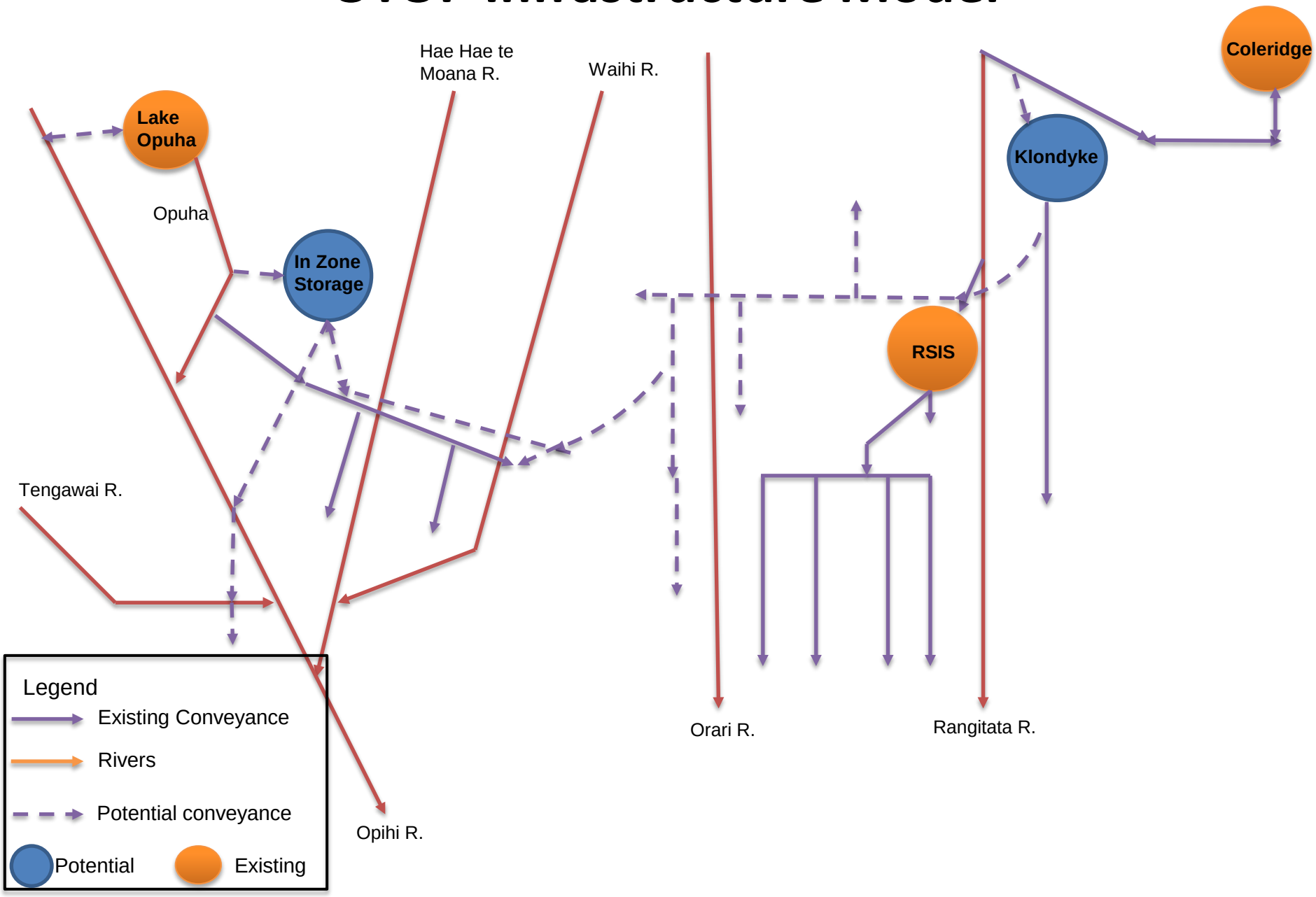
'Investigate opportunities for new water in zone from the Rangitata or Waitaki catchments for environmental and economic purposes.'

Orari-Opihi-Pareora ZIP R3.2.4 New infrastructure supports delivery of the principles and targets of the CWMS

If financially viable and the mixing of water issue is addressed with Te Rūnanga o Arowhenua, then any new storage or distribution infrastructure that makes additional water available in the zone must support a flow and share regime that:

- *enhances reliability and security of supply for human and stock drinking water, industry and agriculture*
- *contributes to meeting water quality standards*
- *sustains river flow and ecosystem dynamics, including appropriate flow variations*
- *protects reliability for current abstractors*
- *supports river/catchment specific values (eg fish passage, mahinga kai, trout, salmon, whitebait etc)*
- *protects, restores and enhances sites of ecological and cultural significance*
- *no net loss of wetlands*
- *requires efficient rural use of water*

OTOP Infrastructure Model



3 Sets of Modelling Experiments:

OTOP North, South and Integrated

Model outputs

- Irrigable area (grouped by location/climate/soil type)
- Large ‘scheme’ storage volumes
- On-farm storage volumes
- Headrace / major conveyance capacity
- Reliability (95% aim, potentially constrained by infrastructure)

Land and Water Regional Plan (2015-18)
Coastal Orari-Opihi

- Coopers, Orari, Rhodes and Ohapi conjunctive use zones:
  Wells <=30 m deep and >= 5 l/s in surface allocation.

- High level stream depletion assessment (effect of 150 days continuous pumping): Of the 119 bores, 60 already have minimum flows. 15 - 32 additional bores tied to min flows.

- **3yrs from operative –** Orari River 500 L/s min flow and 1:1 flow sharing up to 1500 L/s (ecological). Partial restrictions up to 2700 L/s.

- New minimum flows likely for other coastal rivers.

North OTOP (Orari-Opihi)

Potential Rangitata (RDR) Supply

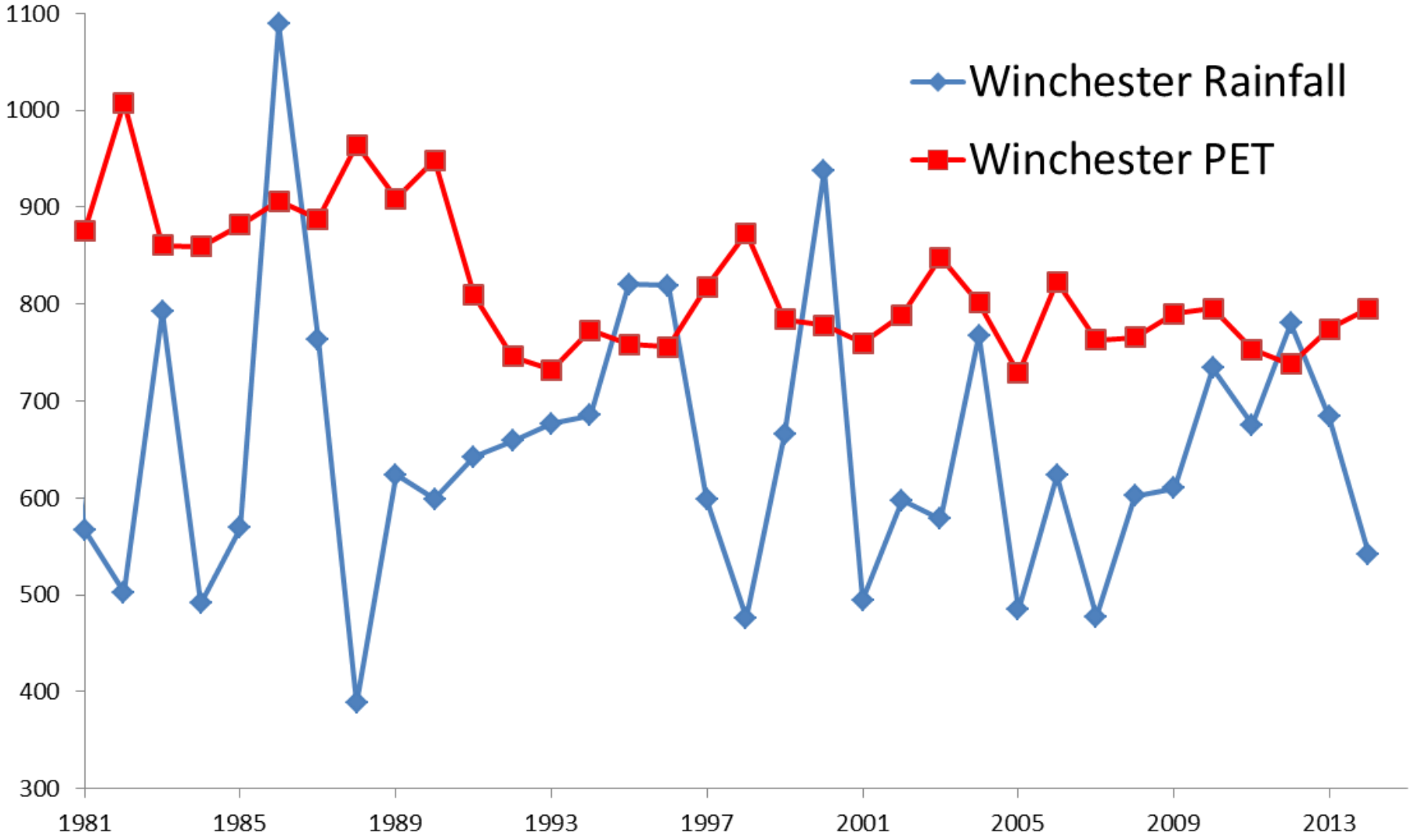
- ~135 potentially affected consent holders surveyed
- Additional 'new' users identified for consideration in modelling
- 61 positive surveys (9500 irrigated ha + 1700 new ha equiv.)
  - 82% would consider 'top up' reliability water
  - 35% would consider total replacement supply
  - 37% would consider additional supply

~20 M m^3/y and 2 m^3/s max pipe capacity

In-Zone Gains?
without new alpine water

- Increased Lake Opuha storage
- Lining Levels Plains scheme
- Implementation of 150 day stream depletion rule
- New minimum flow regime
- Re-allocation of 400 l/s lower Kakahu Scheme
- Additional in-scheme storage
- Upper Ashwick canal (Opihi to Lake Opuha)
- Soil moisture deficit-based demand

N.B. Modelled timeframe is 1981-2011. Assumes Lake Opuha and current irrigated area in place for full period.



Increasing Lake Opuha Operating Level

- ~ 6 M m^3 extra volume by filling to maximum design level when required
- Enabled by down-stream weir upgrade

Lining Levels Plains Scheme

- Ave losses of 280 l/s
- Currently provides water quality and quantity benefits
- Overall benefits greater by implementing 150 day stream depletion assessments and lining scheme races

Canterbury Land and Water Regional Plan

Schedule 9 Assessment of Stream Depletion (Modelled) Effect

Direct: Effect of 7d abstraction >= 90% of rate.

- Include max daily rate and 100% annual volume in surface water allocation. Subject to min flows.

High: Effect of 7d abstraction < 90% but 150d >= 60% of rate.

- Include modelled/pumped daily rate and 75% annual volume in surface water allocation. S.t. min flows.

Moderate & Low: Not subject to min flows.

Initial non-binding 150 day stream depletion assessment

- Above Saleyards Bridge 1478 l/s
  Not affiliated: 271 l/s
- Below Saleyards Bridge 1008 l/s
  Not affiliated: 608 l/s
- Total of 271+1008=1279 l/s potential top-up demand

No current top-up supply option

ORRP Rule 2 (1) Opuha Releases

Opihi River min flow bands

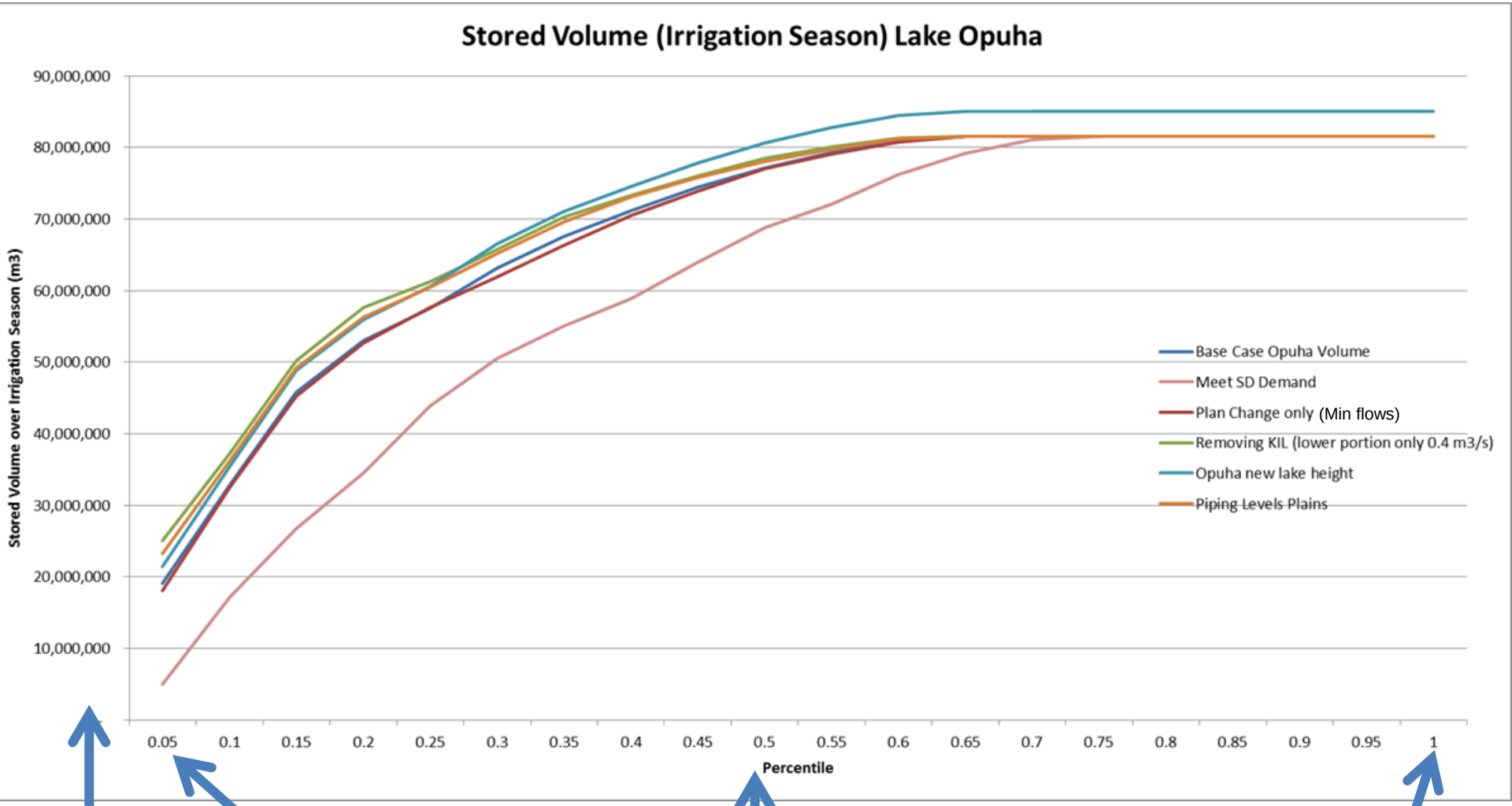
- Current 370-375, >=375 m asl
- Potential 370-380, 380-385, >=385 m asl

Opihi River min flows by month

- Current: Absolute min flows with 48 hour changeover
- Potential: Average flows with absolute minimum to provide for flow variability. *Different min flows for very dry seasons (To Do)?*

Lake Opuha artificial fresh releases

- Current: Compensation by reducing to 370-375 min flows immediately after fresh
- Potential: Adaptive management, eg flow reduction may be more beneficial before release?



Sept-April inflow

Driest season: 1988/89

Average season

Wettest season

Soil moisture deficit-based demand

- Soil moisture deficit-based demand requires accurate soil moisture measurement, weather forecasting and irrigation control
- In the driest modelled year, total demand was similar to 0.41 l/s/ha (Opuha shareholding)
- In a dry year, modelled coastal demand can be 40-50% higher than Ashwick Flats demand
  - Future issues of equity, water swap volumes…?

Additional in-scheme storage

- Benefits include increased overall storage and increased reliability for connected users
- Challenges include how to prioritise supply and management of restrictions

10 m^3/s Opihi-Opuha Canal

- Sporadic contribution from Opihi, potentially with high sediment
- Reduced Opihi freshes
- Expensive

Expt 3: Integrated North and South (To Do)

- What is the demand shortfall from combining Expt 1&2 potential demand and promising In-Zone Gains?

Next Steps – new project (To Do)

- Opuha seasonal inflow forecasting
- Opuha/Opihi adaptive management concepts
- Opuha/Opihi demand survey (incl. additional irrigated area)
- Preliminary infrastructure design and cost options
- Commercial arrangements and scheme governance