Groundwater Recharge Under Irrigated Agriculture – Preliminary Results From The Canterbury Lysimeter Network

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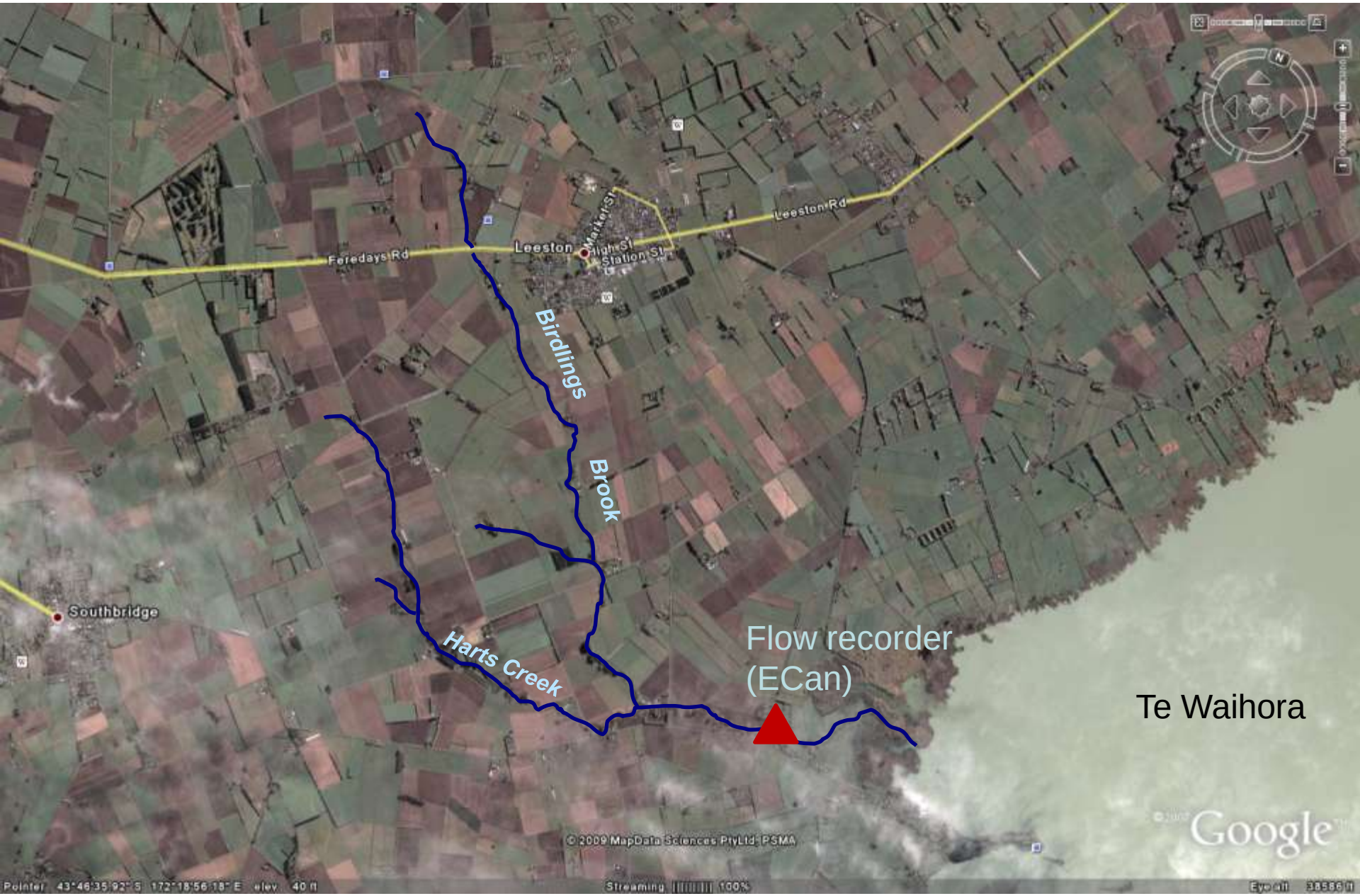
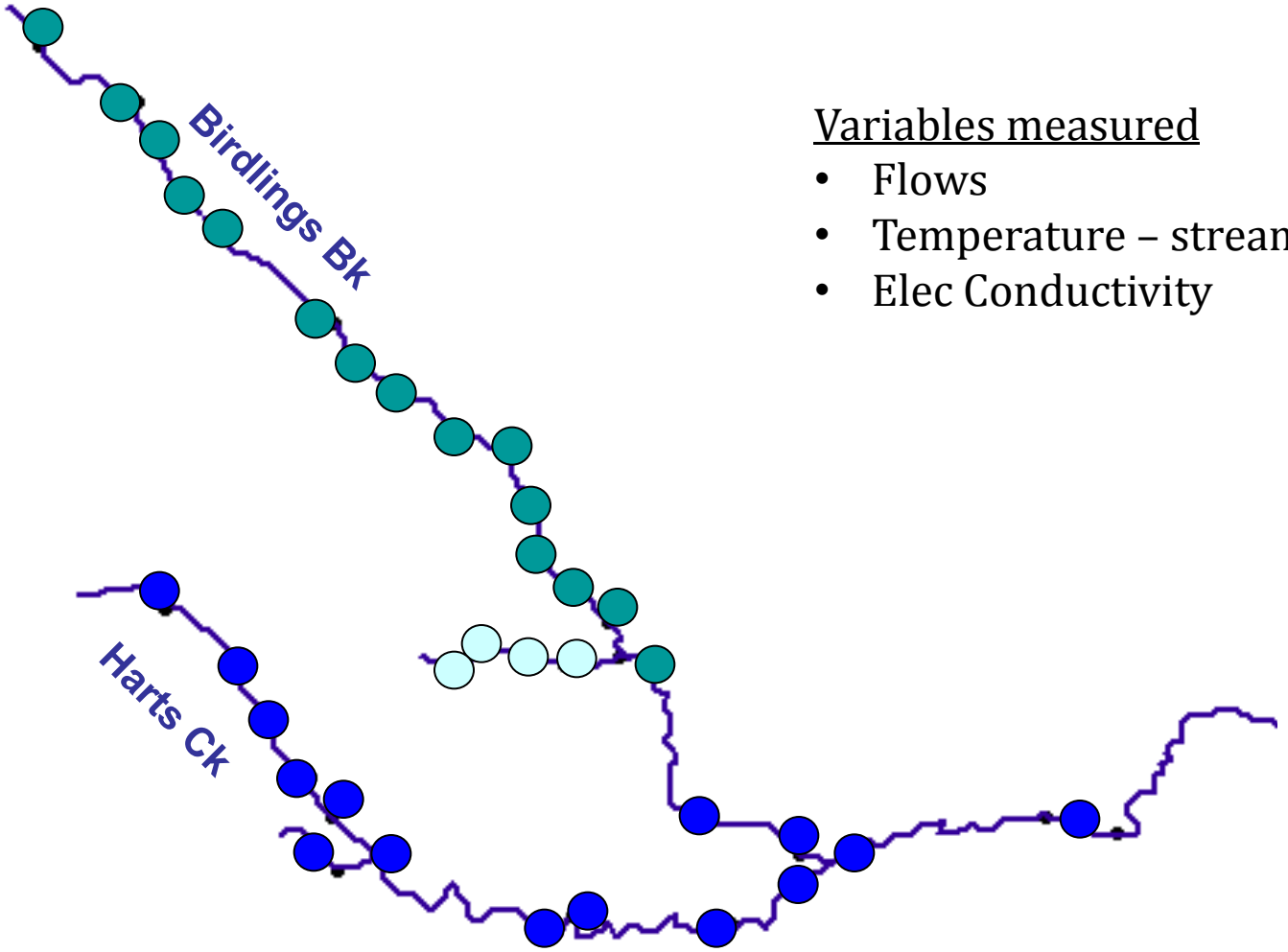
Living Lake,
Changing Catchment
November 15, 2011

Harts Creek Catchment



Profile locations

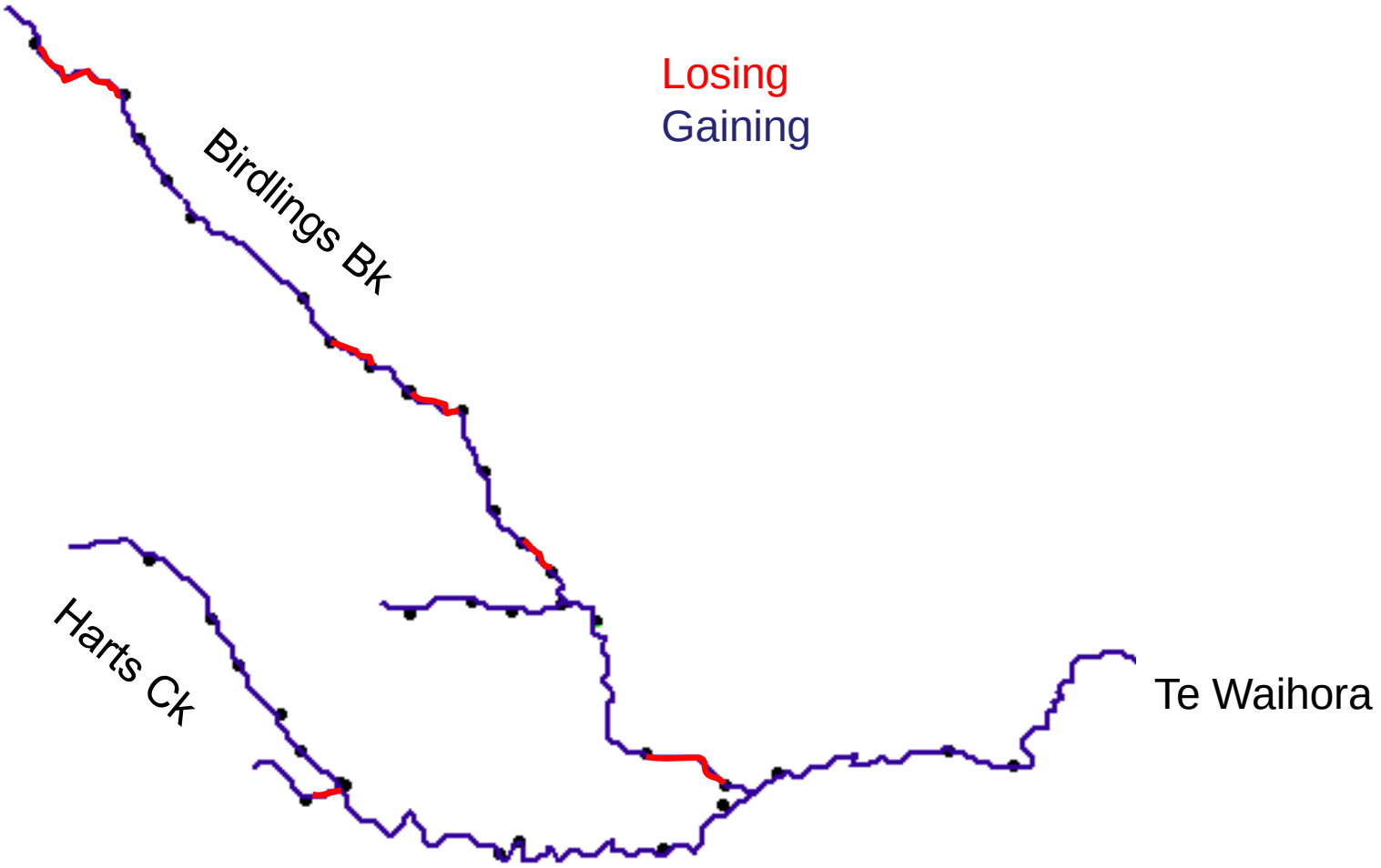


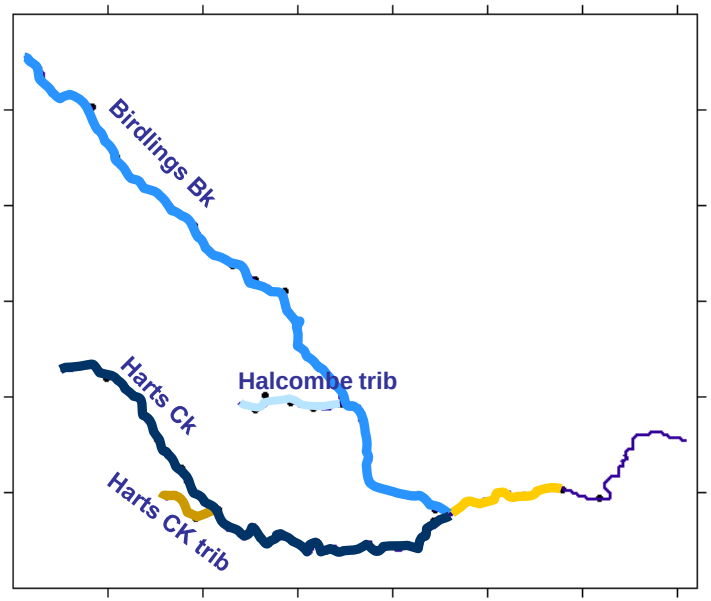
Variables measured

- Flows
- Temperature – streambed and below
- Elec Conductivity

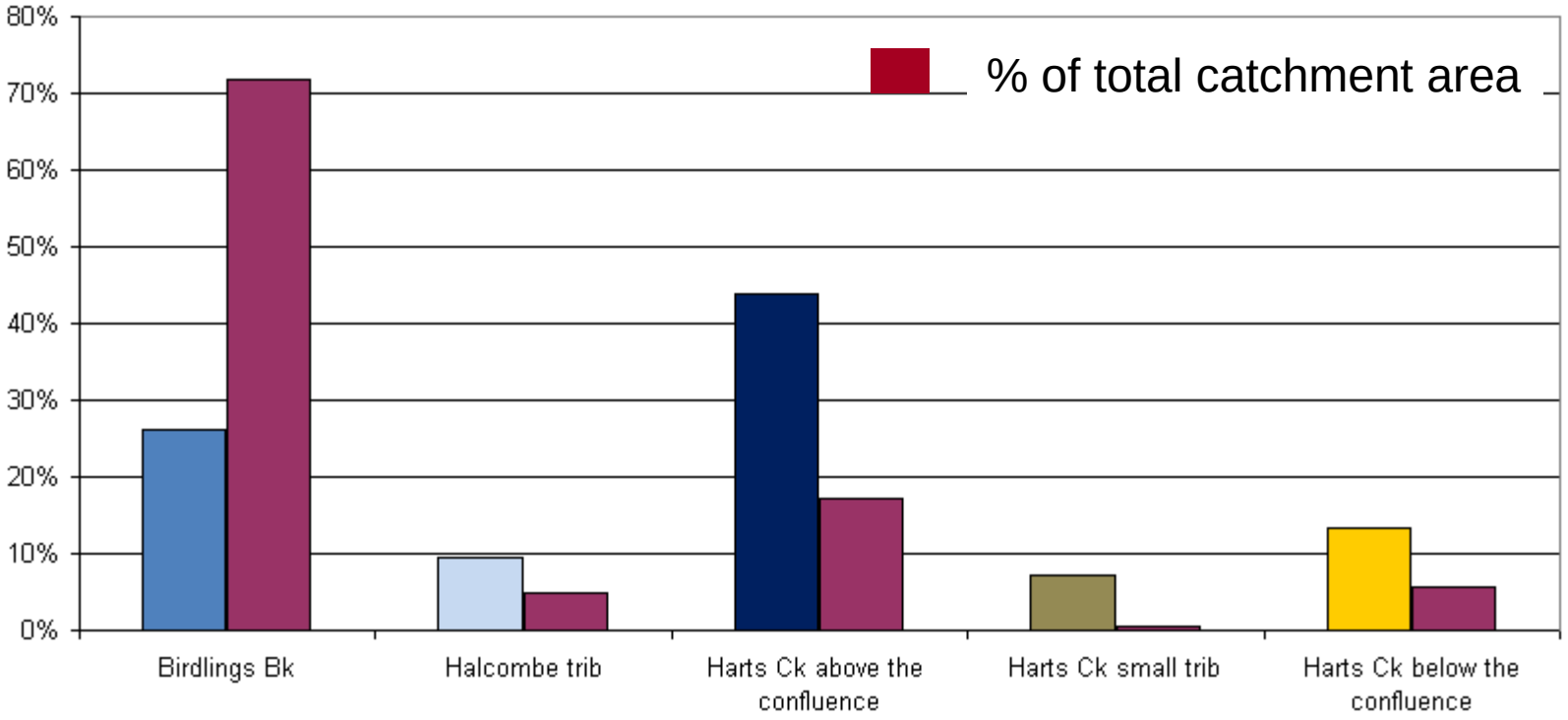
Mapping losing and gaining reaches

a snap shot from September 2009





Flow versus catchment area



Questions…. and more of them….

Discharge catchments (lowland catchments)

? source of water
? seasonality – irrigation versus non-irrigation
? implication to local catchment – land use, water management
? quantification of discharge (seepage rates)

Recharge catchments (upland/foothill catchments)

? quantification of recharge rates/patterns/events

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ECan initiative

- Problem: Can rainfall/irrigation recharge be quantified?
  - allocation of groundwater
  - effect on lowland discharge areas
  - transport of nutrients to groundwater

- Solution: a network of drainage lysimeters sampling the range of climates, soils and land covers

- Participants: ECan, NIWA, Aqualinc, HydroServices and farmers

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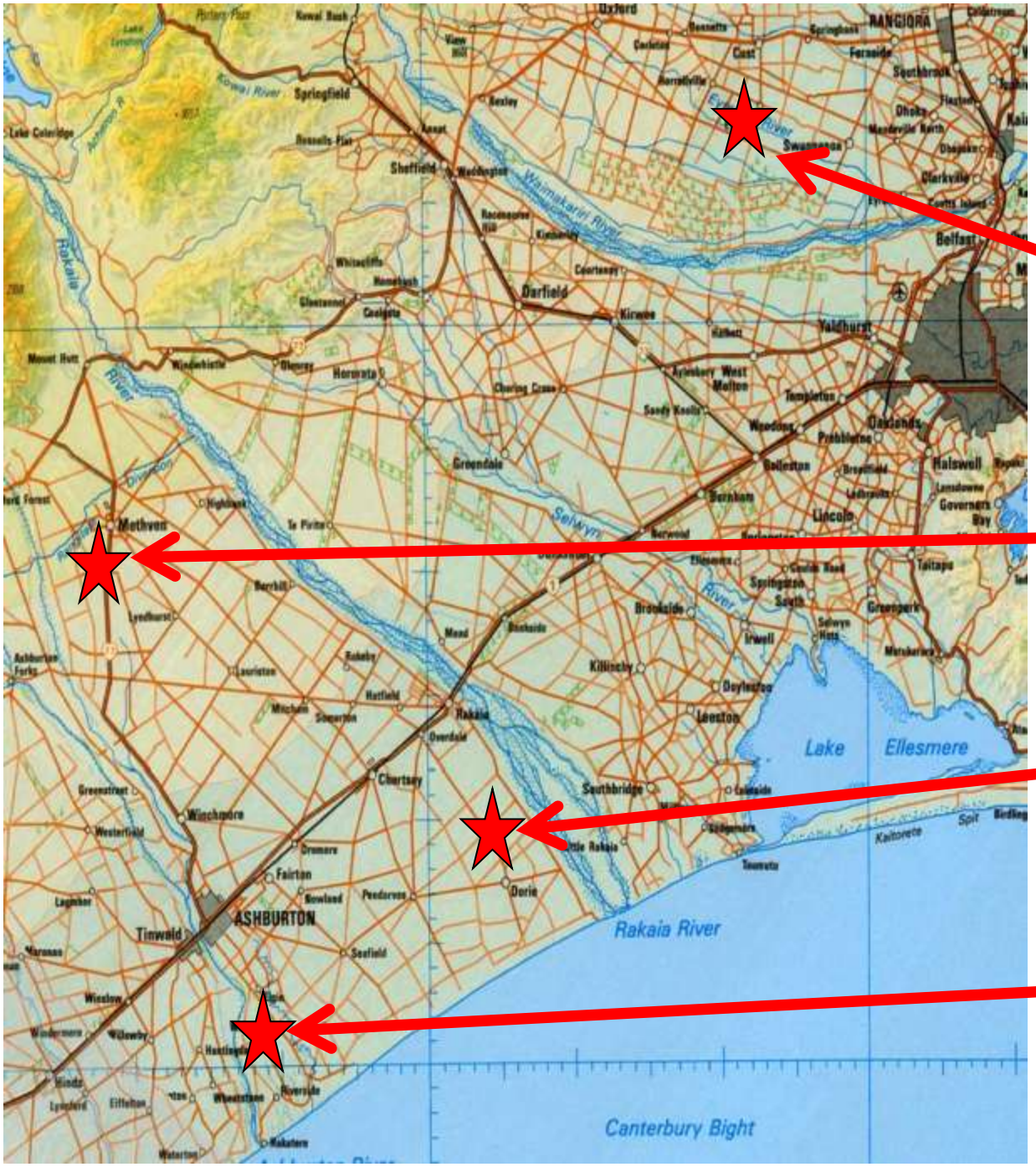


Lysimeter sites

West Eyreton (Jul 2011)
Rain ~550 mm/y,
shallow stony soils,
dairy

Methven (Aug 2010)
Rain ~900 mm/y,
shallow stony soils,
dairy

Dorie (Aug 2010)
Rain ~550 mm/y,
deep silt loam, dairy

Wakanui (May 2011)
Rain ~ 550 mm/y,
deep silt loam,
cropping.

Drainage lysimeter

Photos: Aqualinc; NIWA

Drainage lysimeter

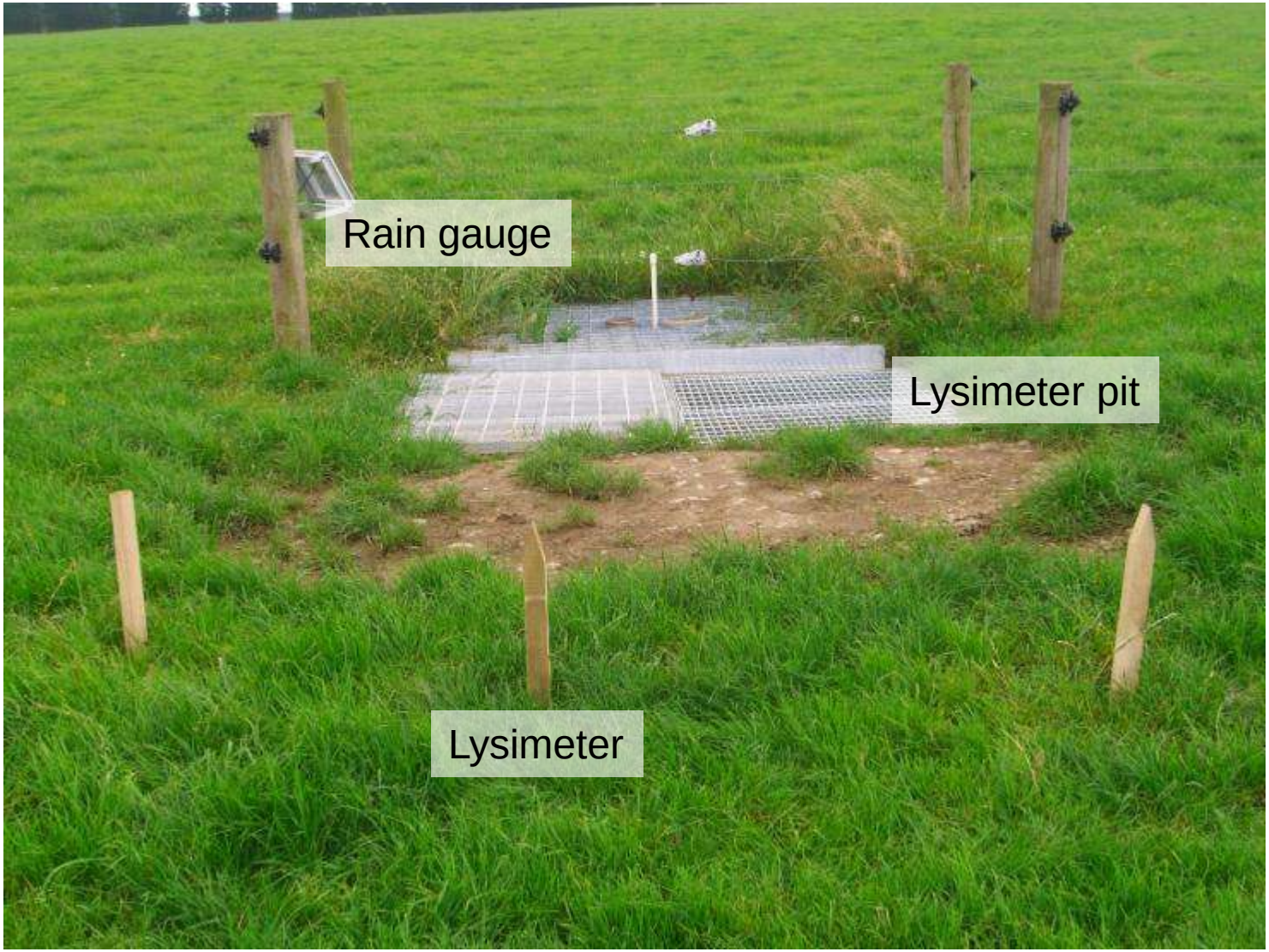
Drainage lysimeter

...filler to avoid end flow…

Drainage lysimeter

...soil moisture sensors...

Drainage lysimeter



Drainage lysimeter

...inside a lysimeter pit…

Rainfall & irrigation measurements

Rain gauge within irrigated area

Rain gauge outside irrigated area

Each site has --

- 3 lysimeters each with a tipping bucket
- 3 soil moisture sensors
- Access tube for Neutron probe in each lysimeter
- Ground-level raingauge – rain and irrigation
- Compact weather station
- Real-time telemetry

- Eddy correlation towers at two sites

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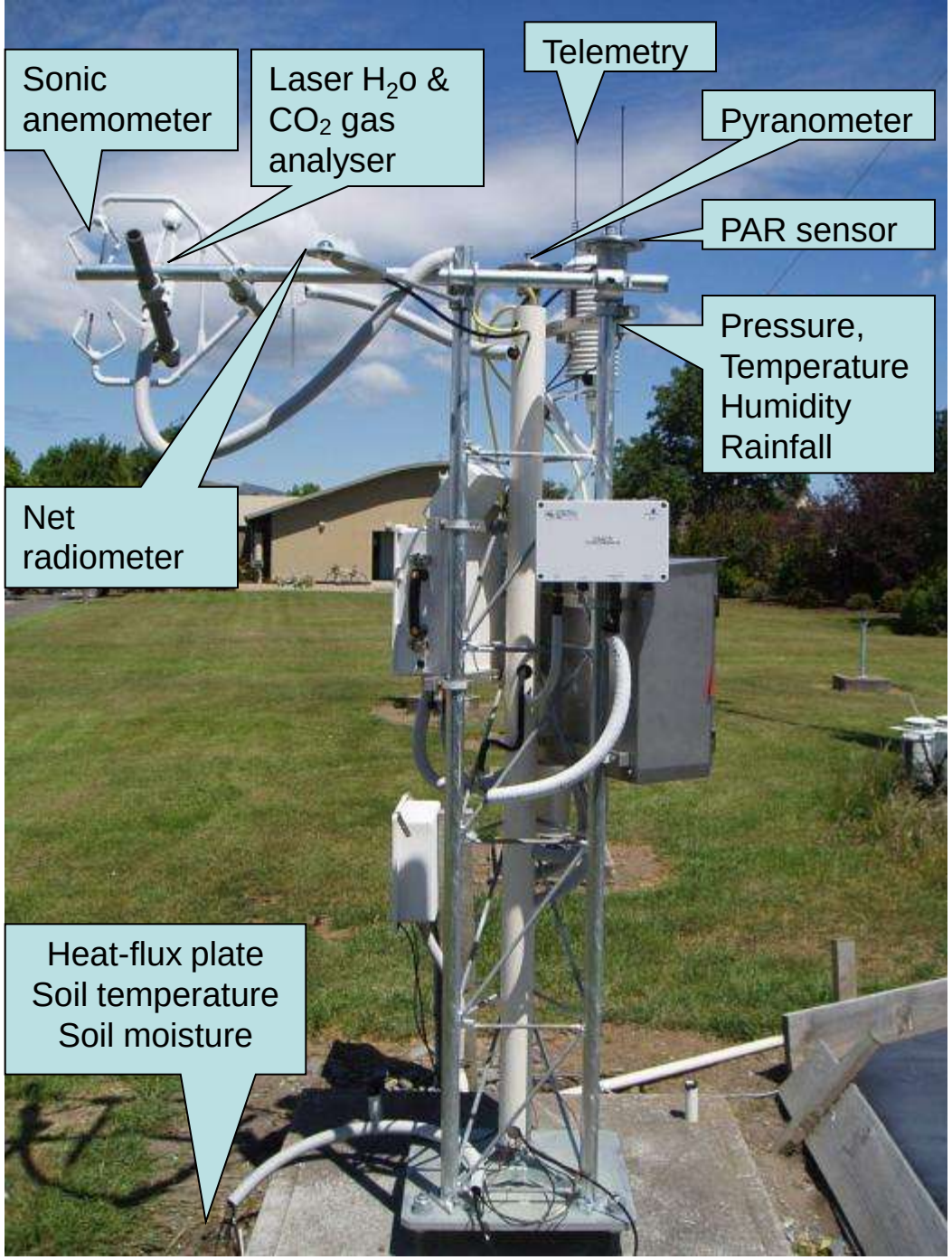

Eddy correlation tower

- measures CO_2 and water vapour fluxes

Science opportunities

- Measurement of ground-water recharge
- Check on irrigation efficiency
- Unique opportunity to compare evapotranspiration estimates from
  - Lysimeter water balance
  - Calculation from meteorological variables (Penman and Priestley-Taylor methods)
  - Direct measurement from eddy correlation tower

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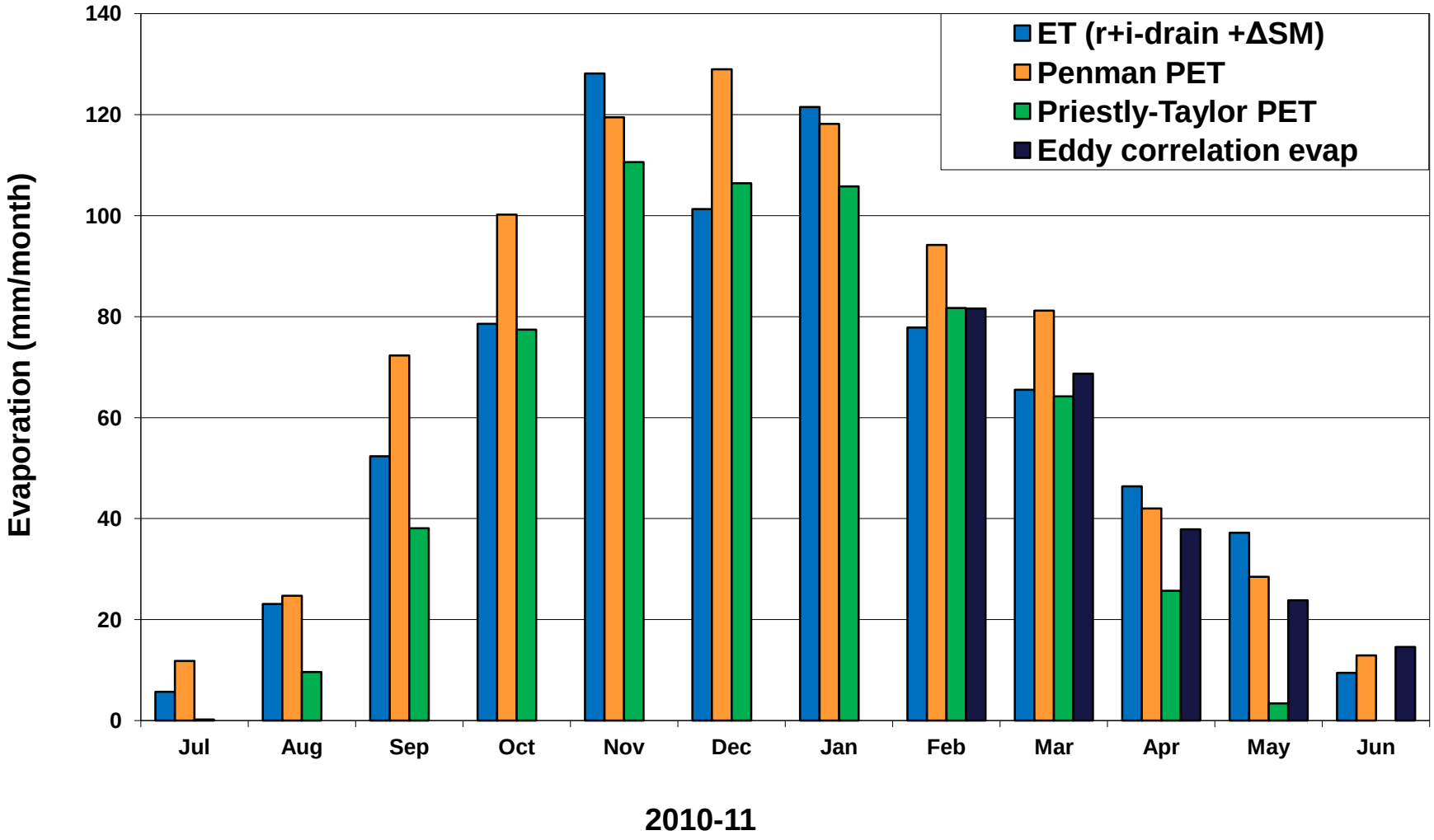
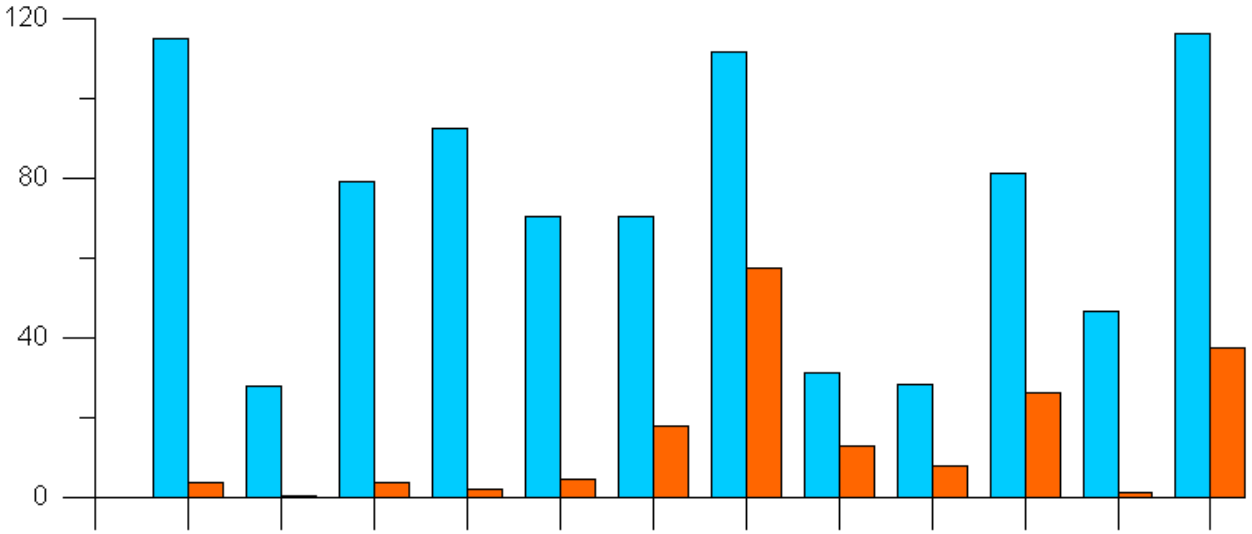
ET estimates and measurements



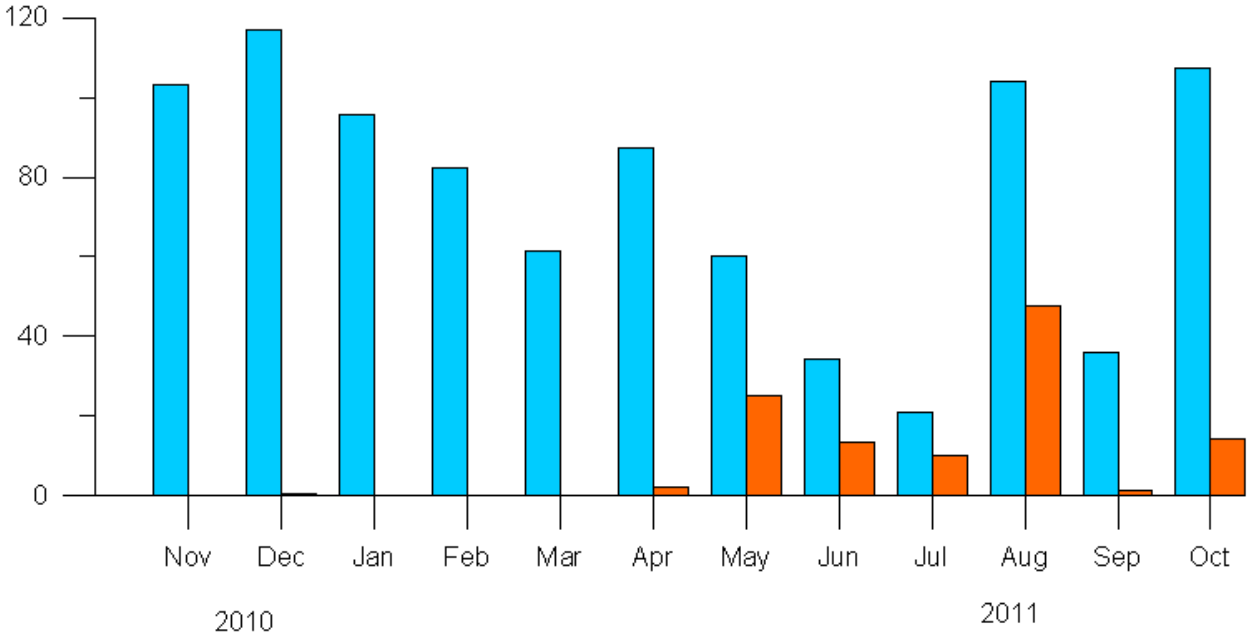
…for a pasture site near Methven...

Monthly summary



Methven

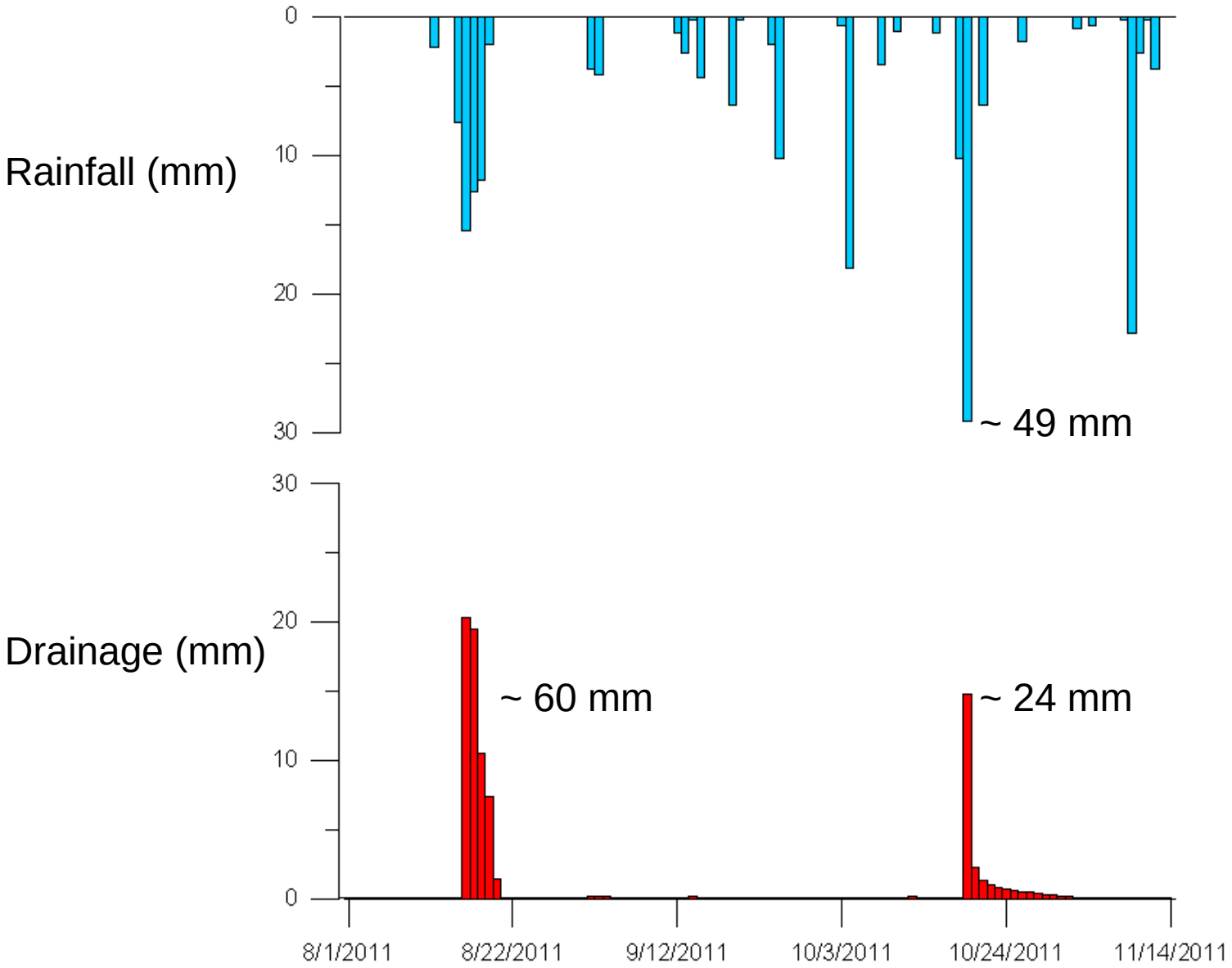
Annual total:
870 mm rainfall
174 mm drainage

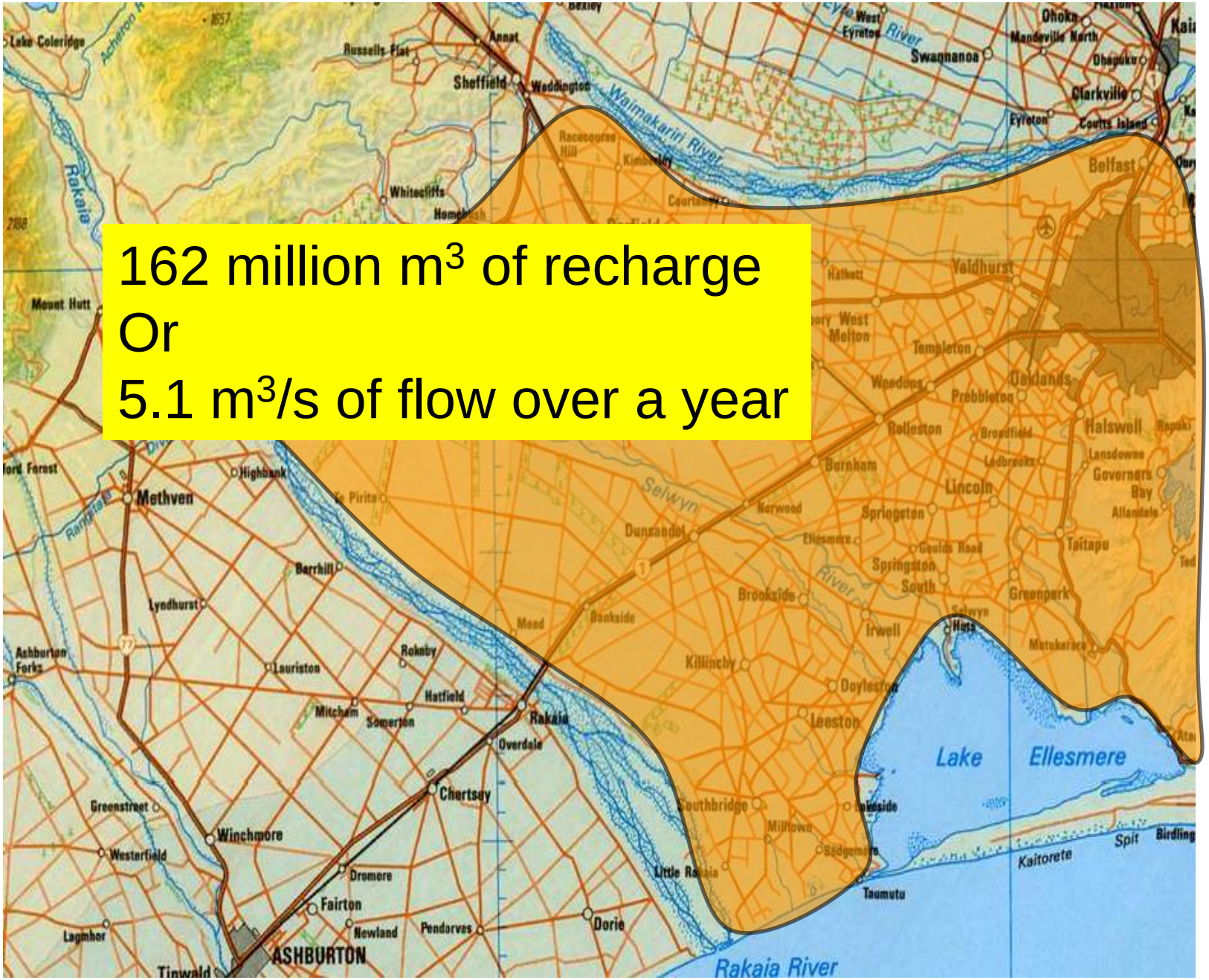


Dorie

Annual total:
910 mm rainfall
116 mm drainage

Specific recharge events




162 million m³ of recharge
Or
5.1 m³/s of flow over a year
Lake Coleridge
Sheffield
Waddington
Waimakariri River
Swannanoa
Clarkville
Belfast
Yaldhurst
Templeton
Oaklands
Halswell
Rolleston
Burnham
Lincoln
Springston
Dunsandel
Selwyn
Methven
Highbank
Barrhill
Lyndhurst
Ashburton Forks
Lauriston
Rakaia
Chertsey
Overdale
Winchmore
Westerfield
Greenstreet
Dromore
Fairton
Newland
Pendarves
Dorie
Lagmhor
ASHBURTON
Tinwald
Lake Ellesmere
Leeston
Killinchy
Irwell
Brookside
Springston South
Greenpark
Taitapu
Kaitorete Spit
Taumutu
Rakaia River

Thanks to…

Craige MacKenzie

Maxine Eric Watson

Willy Leferink

Graeme Sutton & Ben McKerchar

ECan, Aqualinc, HydroServices, Landcare, AgResearch, Plant & Food

WATCH THIS SPACE FOR MORE ON CANTERBURY LYSIMETER NETWORK

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