CHRISTCHURCH WEST MELTON WATER MANAGEMENT ZONE COMMITTEE

AGENDA

THURSDAY 23 AUGUST 2012

AT 6PM

THE BOARDROOM, FENDALTON SERVICE CENTRE

Committee:
Ian Fox, Community Representative (Chairperson)
Councillor Sally Buck, Christchurch City Council
Deidre Francis, Community Representative (Deputy Chairperson)
Jon Harding, Community Representative
Councillor Debra Hasson, Selwyn District Council
Arapata Reuben, Tūāhuriri Rūnanga
Yvette Couch-Lewis, Rāpaki Rūnanga
Hugh Thorpe, Community Representative
Robert Wynn-Williams, Community Representative
Ann Winstanley, Community Representative
Commissioner Rex Williams, Environment Canterbury

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INDEX

CHRISTCHURCH WEST MELTON WATER MANAGEMENT ZONE COMMITTEE 23. 8. 2012

1. APOLOGIES

2. CONFIRMATION OF MINUTES – 25 JULY 2012

The minutes of the Committee meeting held on 25 July 2012 are attached.

The Committee is asked to approve these minutes as a true and accurate record of the meeting.

3. DEPUTATIONS BY APPOINTMENT

4. IDENTIFICATION OF URGENT ITEMS

5. IDENTIFICATION OF ANY GENERAL PUBLIC CONTRIBUTIONS

CHRISTCHURCH WEST MELTON WATER MANAGEMENT ZONE COMMITTEE
25 JULY 2012

A meeting of the Christchurch West Melton Water Management Zone Committee was held at Wigram Manor, 14 Henry Wigram Drive on Wednesday 25 July 2012 at 6pm

PRESENT: Ian Fox, Community Representative (Chairperson)
Deidre Francis, Community Representative (Deputy Chairperson)
Jon Harding, Community Representative
Councillor Debra Hasson, Selwyn District Council
Arapata Reuben, Tūāhuriri Rūnanga
Yvette Couch-Lewis, Rāpaki Rūnanga
Hugh Thorpe, Community Representative
Robert Wynn-Williams, Community Representative
Ann Winstanley, Community Representative

APOLOGIES: An apology for absence was received and accepted from Commissioner Rex Williams.

An apology for lateness was received and accepted for Ann Winstanley who arrived at 6.08pm and was absent for clause 1.

Councillor Debra Hasson arrived at 6.16pm, and was absent for clauses 1, 2,3,4, and 5.

The meeting was opened with a karakia from Arapata Reuben.

1. CONFIRMATION OF MINUTES

It was **decided** that the minutes be approved as a true and accurate record of the meeting, subject to Herena Stone's name being removed in the list of present members.

2. DEPUTATIONS BY APPOINTMENT

Nil.

3. IDENTIFICATION OF URGENT ITEMS

Nil.

4. IDENTIFICATION OF ANY GENERAL PUBLIC CONTRIBUTIONS

Nil.

5. REGIONAL COMMITTEE UPDATE

The Committee received a verbal report from Jon Harding on the work of the Regional Committee, including reference to the following key areas of work:

- the Regional Committee has produced a social and economic aspiration framework which will come to the Zone Committees in due course aimed at ensuring focus on these issues during the drafting of the ZIP
- the Environment Canterbury's draft Regional River Gravel Management Strategy was open for consultation and submissions
- Canterbury District Health Board highlighted Nitrate toxicity as a key topic relating to health within the CWMS

5 Cont'd

- discussion on the regionally significant features in the Orari-Opihi-Pareora, Upper Waitaki, and Lower Waitaki Zones
- update on the draft Land and Water Regional Plan, noting that 10 per cent of farmers in the region would have difficulty reaching these objectives.

6. FLOODING AND FLOOD MANAGEMENT

The Committee received a presentation on flooding and flood management. Matthew Ross outlined the purpose of this item as to enable the Committee to consider the impact of certain activities, specifically relating to flooding, on the implementation and achieving the targets decided by the Committee in the ZIP.

7. PRIORITY ISSUE WORKSHOP – FLOODING AND FLOOD MANAGEMENT

The Committee split into groups to discuss key issues relating to flooding and flood management.

The following key areas were identified:

- considering endorsing existing management plans to ensure consistence with the ZIP
- direct impact on management activities on in stream fauna etc
- level of flood protection provided.

8. IMMEDIATE STEPS

The Committee discussed proposal on the allocation of the immediate steps funding. The Committee discussed the merits of different approaches to funding, including whether to allocate to a single, large project, or to several smaller projects.

It was **moved** by Hugh Thorpe, seconded by Councillor Debra Hasson, that the Committee refer this issue to a workshop to consider a more refined proposal to be presented to the Committee at its next meeting on 23 August. Following further discussion on the proposal, the motion was **withdrawn** with the consent of the meeting.

It was **decided** that the Committee approve the proposed approach as a working draft to use as a basis to assess applications.

The Committee noted that each project would be assessed on its merit and on its potential outcome.

9. WATERWAY SILT REMOVAL PROGRAMME

The Committee had received a presentation on the Christchurch City Council's waterway silt removal programme at its meeting on 23 February 2012, and had noted that it was comfortable on the overarching approach being taken by the Council.

The Committee received the programme of works for silt clearance in rivers which was requested at the previous meeting. The Committee thanked the staff for the programme, and noted there were no significant points that required further exploration by the Committee at this time.

10. STORMWATER MANAGEMENT PLANS AND GLOBAL STORMWATER CONSENTS

The Committee received a presentation from the Christchurch City Council on stormwater management plans and global consents.

The Committee noted that it was supportive of the general approach being taken by the Council, and did not identify any significant areas for further exploration by the Committee.

11. DRAFT LAND AND WATER REGIONAL PLAN

The Committee received a presentation from Peter Constantine on the draft Land and Water Regional Plan.

The Committee noted the following significant areas for further consideration:

- Piling and the impact of further piling.
- Geotechnical bores and drilling practices

12. EARLY ENGAGEMENT WORKING DRAFT ZONE IMPLEMENTATION PLAN (ZIP)

The Committee received a working draft of the early engagement ZIP. The Committee noted the information, and were happy for this version to be used for early engagement.

13. WORK PROGRAMME TO ZIP

The Committee considered its upcoming work programme, including details of upcoming meetings and workshops leading up to the ZIP.

The Committee requested that the interaction of the rivers and aquifers be considered by the Committee.

The Committee discussed the intention to hold a meeting with targeted interest groups on 8 August, to be confirmed with the Committee.

The meeting was closed with a karakia from Arapata Reuben.

The meeting concluded at 9.19pm

CONFIRMED THIS 23RD DAY OF AUGUST 2012

IAN FOX
CHAIRPERSON

25. 7 .2012

23 August 2012

ATTACHMENT TO CLAUSE 8

DISCUSSION

Possible approach to Immediate Steps funding?

- Projects related to the following ecosystems are prioritised:
  - Spring heads
  - River mouths / hapua i.e. Brooklands Lagoon, Waimakariri River
  - Avon-Heathcote Estuary/Ihutai
  - Wetlands*
  - Other (projects that score highly on cultural and ecological assessment)

- Projects that are led by, or involve existing community groups are prioritised

- Accrued funds for Years 1 & 2 ($200,000) are combined and allocated to a single larger scale project as soon as possible

- A new general call for projects for Years 3, 4, 5

- Environment Canterbury identify a package of projects for the zone committee to consider and endorse at the November 2012 public meeting

*The Zone Committee will receive additional information on significant wetland ecosystems at the August 2012 meeting

6. REGIONAL COMMITTEE UPDATE 6.10PM TO 6.20PM

AGENDA ITEM NO: 6		**SUBJECT MATTER:** Regional Committee update
REPORT:	Christchurch West Melton Zone Committee	**DATE OF MEETING:** 23 August 2012
REPORT BY:	Jon Harding, Committee Member	

PURPOSE

This agenda item is for the Zone Committee to be briefed on items of relevance to the zone arising from the latest meeting of the Regional Committee of the Canterbury Water Management Strategy.

BACKGROUND

The Regional Committee's latest meeting was held on 14 August 2012 at Wigram Manor, Christchurch.

Jon Harding is the Christchurch West Melton Zone Committee's representative on the Regional Committee and will give a verbal brief at the public meeting.

CHRISTCHURCH WEST MELTON WATER MANAGEMENT ZONE COMMITTEE 23. 8. 2012

7. UPDATE ON ENVIRONMENT CANTERBURY POLLUTION PREVENTION WORK PROGRAMME

6.20PM TO 6.50PM

AGENDA ITEM NO: 7		**SUBJECT MATTER:** Update on Environment Canterbury Pollution Prevention Work Programme
REPORT:	Christchurch West Melton Zone Committee	**DATE OF MEETING:** 23 August 2012
REPORT BY:	Paul Gofton, Environment Canterbury	

PURPOSE

This agenda item is for the Zone Committee to be updated and comment on Environment Canterbury's Pollution Prevention Work Programme.

BACKGROUND

The Zone Committee will be asked to consider the alignment of Environment Canterbury's Pollution Prevention Work Programme in the context of the working draft Zone Implementation Programme.

ATTACHMENTS

- Workflow charts/diagrams (x3) (**attached**)
- A presentation will be tabled at the meeting including a short DVD on a restoration project.

ATTACHMENT 1 TO CLAUSE 7 CWM ZONE COMMITTEE 23.8.2012

PAINT WASH WATER PROJECT

Project Lead Officer – Hannah Eastgate

Phase 1:

EDUCATION AND PROMOTION OF BEST PRACTICE FOR MANAGING PAINT WASTE

Included:

Pre-testing and evaluation, radio adverts, hard copy promo material and developing relationships with industry, CCC and ITOs

CERA Recovery Strategy:

Standards for waste management (including concrete & paint wash water) and erosion & sediment control in line with CERA recovery strategy 17.1 Objective

6.1. Ensuring recovery activities value, protect and sustainably manage the sources of our water

Phase 2:

Target focus on Trade

****Paint industry identified as high risk factor, due to the scale and intensity of the Canterbury Recovery programme - estimated 6000 painters will be working at the peak.***

OBJECTIVES

1. ***Create widespread industry awareness of environmental best practice for managing paint waste.***
2. ***All trade painters in Canterbury working to environmental best practice standards***
3. ***Training on environmental management (including paint wash waste) permanently integrated into industry training programmes (eg Site Safe)***
4. ***Paint wash waste forms part of an Environmental Policy required for all contractors working on the Canterbury Rebuild.***
5. ***Line of sight with CERA Recovery Strategy, "N.E.R.P", ECan 2012 – 2022 Strategy and possible CWMS ZIP Objectives.***

KEY COMPONENTS

INDUSTRY LINKS

CERA/SCIRT

Partner with CERA/SCIRT to drive requirement for environmental policies for all rebuild contractors as a necessity to meet environmental best practices.

CCC

1. Work with CCC to develop trade waste licence & disposal options to integrate a requirement in the PMO contracting process.
2. CCC to require WMPs for all contractors.
3. CCC Bylaw review to consider inclusion of contaminant discharges.

PMOs

Work with PMOs to implement requirement for paint industry wash water disposal process for all contractors:

1. **Trade waste licence**
2. **contained wash system and/or**
3. **collection & cleaning contract**

Master Painters

Work with Master Painters to include waste management practices as part of criteria for becoming a Master Painter.

Decorate NZ

Work with ITO to integrate training courses into CPIT and strengthen relationships with trade

Dulux/Resene/Trade

Work with trade to develop awareness campaigns for trade painters. Explore/promote contained wash water systems (*Envirowash* etc) by trade.

TRAINING

SCIRT

Educate SCIRT on importance of safe disposal of paint wash water.

Site Safe

Work to have environmental management integrated into Site Safe courses. Ecan provide training material and "train the trainers".

CPIT

Work with CPIT to incorporate environmental management, including paint waste, as part of their trade courses.

RESOURCES

Paint lid stickers

Work with trade to develop paint lid stickers or similar.

Universities

Make connections and engage help in multiple aspects of project from Canterbury/Lincoln University.

Training

Develop training courses to "train the trainers" – presentations/hard copy reference materials/website.

TrainingVideo

For inclusion on website and other training programmes.

Awareness Campaigns

(*For general public awareness)* Radio ads & sponsored bus backs. Potential for bus backs to link with kids poster competition.

Social Media

(*For general public awareness)* Use internet & social media to raise general awareness. Link social media to potential competitions to generate interest – photo competition/kids poster competition.

Website

Develop trade specific web page/site for information and options available for safe disposal.

Pamphlets/Pocket Books

Develop trade specific pamphlets for general information or pocket guides to be used for reference on site. (Input into Builders Pocket Guide).

Environmental Plan

Develop a Waste Management Plan for trade painters' use and adaption for each site, to assist with correct disposal of paint wash waste.

Compiled by : H Eastgate - ECan 17/07/12

ATTACHMENT 2 TO CLAUSE 7
CWM ZONE COMMITTEE 23.8.2012

CONCRETE WASTEWATER PROJECT

Project Lead Officer – Kevin Moran

Target focus - Trade

EDUCATION AND PROMOTION OF BEST PRACTICE FOR MANAGING CONCRETE WASTEWATER

Included:

Pre-testing and evaluation, hard copy promo material and increasing awareness and use of BMPs through liaison with industry, CCC and ITOs

Canterbury Rebuild Project:

Environmental Policies for:

- Waste management (including concrete & paint waste water)
- Erosion & sediment control

CERA Recovery Strategy:

Standards for waste management (including concrete & paint wash water) and erosion & sediment control in line with CERA recovery strategy 17.1 Objective 6.1. Ensuring recovery activities value, protect and sustainably manage the sources of our water

KEY COMPONENTS

OBJECTIVES

1. **Raise awareness of the link between the stormwater network and surface water and the potential impacts of wastewater discharges.**
2. **Create widespread industry knowledge of environmental best practice for managing concrete wastewater.**
3. **All contractors working with concrete in Canterbury working to environmental best practice standards**
4. **Concrete wastewater forms part of an Environmental Policy required for all contractors working on the Canterbury Rebuild.**
5. **Be in line with CERA Recovery Strategy "N.E.R.P", ECan 2012 – 2022 Strategy and CWMS ZIP Objectives.**

INDUSTRY LINKS

CERA/SCIRT

Partner with CERA/SCIRT to drive requirement for environmental policies for all rebuild contractors as a necessity to meet their key goal.

CCC

1. CCC Trade waste options for contractors/waste water handlers
2. Investigate possible use of eco-depots or other sites to allow safe disposal of concrete wash water throughout CHCH.
3. Work with CCC to take enforcement action against contractors polluting stormwater.
4. CCC to require WMPs for all contractors to ensure appropriate methods being utilised for any work under their control.

PMOs

Work with PMOs (Arrow/Mainzeal/Hawkins/Fletchers) to identify and promote standard wastewater management solutions and to implement the requirement for appropriate concrete wastewater disposal for all contractors.

TRAINING

SCIRT

Partner with SCIRT to develop an agreed process for safe disposal of concrete wastewater which all staff will be trained in.

PMOs

Partner with PMOs to develop an agreed process for safe disposal of concrete wastewater which all staff will be trained in.

Site Safe

Work towards having environmental management integrated into Site Safe courses. ECan provide training material and "train the trainers".

CPIT

Work with CPIT to incorporate environmental management as part of their trade courses.

RESOURCES

Awareness Campaigns

'Bumper stickers' Trade/Industry advertising.
Part of general IUWH programme.

Back of bus advertising & student input

University of Canterbury

Explore & develop opportunities to utilise UC expertise & resources to provide input to programmes

Website

Develop trade specific web page/site for information and options available for safe disposal.

Pamphlets/Pocket Books

Develop trade specific pamphlets for general information and input into builders pocket guide to be used for reference on site.

Environmental Plan

Develop a generic Environmental Plan that contractors can use and adapt for each site to assist with correct disposal of waste.

Training Video

For inclusion on website and other training programmes

Training

Develop training courses to "train the trainers" – presentations/hard copy reference materials/website.
Possible links to CPIT for inclusion in builder's apprenticeship?

Compiled By: H Eastgate 17/07/12

ATTACHMENT 3 TO CLAUSE 7
CWM ZONE COMMITTEE 23.8.2012

Erosion and Sediment Control Project

Project Lead Officer – Jocelyn Muller

Erosion & Sediment Control

(E&SC)

KEY COMPONENTS

Current Training

Training workshops and guide provided by ECan for E&SC for:

- Earthworks site contractors
- Consultants/Local Authority Staff/Site managers
- E&SC Plans
- Chemical use

CERA Recovery Strategy:

Standards for waste management (including concrete & paint wash water) and erosion & sediment control in line with CERA recovery strategy 17.1 Objective
6.1. Ensuring recovery activities value, protect and sustainably manage the sources of our water

OBJECTIVES

1. **Create widespread industry awareness of environmental best practice for managing E&SC**
2. **All contractors in Canterbury working to environmental best practice standards**
3. **Training on environmental management (including E&SC practices) permanently integrated into industry training programmes (e.g. Site Safe or similar)**
4. **E&SC forms part of an Environmental Policy required for all contractors working on the Canterbury Rebuild.**
5. **Line of sight with CERA Recovery Strategy, "N.E.R.P", and ECan 2012 – 2022 Strategy and possible CWMS ZIP Objectives.**

INDUSTRY LINKS

CERA/SCIRT
Partner with CERA/SCIRT to drive requirement for erosion & sediment control plans for all rebuild contracts as a necessity to meet environmental best practices.

Suppliers
Liaise with industry to identify and promote most appropriate and environmentally sustainable materials & products.

CCC
1. **CCC to require ESCs for all sites.**
2. **CCC to inspect, monitor & enforce ESCs**
3. **CCC to assist with awareness programmes.**

PMOs
- PMOs to implement requirement for E&SC training for all contractors
- PMOs to implement requirement for E&SC plans for all sites

TRAINING

SCIRT
Partner with SCIRT on E&SC plans and training all staff

Site Safe
Work to have environmental management integrated into Site Safe courses. ECan provide training material and "train the trainers".

Digger School
Continue training with Christchurch Digger School & develop new training options (building apprenticeship input)

Training workshops
Continue ECan led training workshops for contractors and local authorities.

RESOURCES

E&SC Guidelines
Continue with review of 2007 E&SC guidelines.

Universities
Explore & develop opportunities to utilise UC expertise & resources to provide input to programmes

Training Video
For inclusion on website and other training programmes

Training
Develop training courses to "train the trainers" – presentations/hard copy reference materials/website

Template Erosion & Sediment Control Plan
Develop a template E&SC Plan for contractors to use and adapt for small sites (less than 1500m^2, to assist with correct E&SC.

Pamphlets/Pocket Guides
Develop trade specific pamphlets for general information or pocket guides to be used for reference on site. (Input into Builders Pocket Guide)

SITE BOARDS
Work with industry to develop site boards to be placed on every site with key information on E&SC measures on site (high risk issues: run-off, de-watering, dust)

Website
Develop trade specific web page(s) for information on E&SC.

Compiled by: H Eastgate - ECan 17/07/12

8. WETLANDS IN CANTERBURY 6.50PM TO 7.50PM

AGENDA ITEM NO: 8	**SUBJECT MATTER:** Wetlands in Canterbury
REPORT: Christchurch West Melton Zone Committee	**DATE OF MEETING:** 23 August 2012
REPORT BY: Tamsin Page Philip Grove Environment Canterbury	

PURPOSE

This agenda item is for the Zone Committee to be briefed on wetlands in the context of Canterbury Water Management Strategy (CWMS).

BACKGROUND

Linked to the context of the CWMS and its specific wetland goals, the presentation will cover some basic information about wetlands and why they are important; the state of wetlands in the region; the regulatory framework related to wetlands; non-regulatory components of Environment Canterbury's wetland work; an explanation of the recently developed regional wetland database; and an overview of wetlands in the Christchurch West Melton Zone. This is part of a "roadshow" that Environment Canterbury is taking to all CWMS committees.

ATTACHMENTS

- Canterbury Wetlands Overview (**attached**).

Canterbury Wetlands Overview

The CWMS contains a number of very specific wetland goals. Collectively, these signal the **protection of all wetlands** as the overall objective, with initial priority on significant wetlands:

- 2010: “prevent further loss of area of naturally occurring wetlands”
- 2015: “protected all and restored at least two significant wetlands in each zone”
- 2020: “protected all existing wetlands”
- 2040: “protected all wetlands”

Reflecting this, all of the ZIPs completed to date and the RIP include recommendations specific to wetlands. A strong trend running through all is the identification and assessment of wetlands, and many also seek the protection of wetlands through working with landowners, and through making wetland assessments and protection a ‘criteria’ for new developments.

This overview document and the accompanying “roadshow” of presentations to CWMS committees and biodiversity working groups over the second half of 2012 has been prepared in response to these ZIP recommendations. This document contains some brief information about wetlands and why they are important, and then outlines the core components of ECan’s programmes that contribute to the protection and restoration of the region’s wetlands, including the regional wetland database; the on-going field survey programme; the regulatory framework; and the non-regulatory components such as incentive funds, advocacy, provision of advice and information, and awareness-raising.

What is a wetland?

'Wetland' is the collective term for the wet margins of streams, rivers, ponds, lakes, lagoons, estuaries, bogs and swamps. A wetland may be large or small, natural or man-made, permanently or intermittently wet. Wetland water may be fresh, brackish or saline. The types of plants and animals found in wetlands depend on the water - its amount, depth, permanence, temperature, the chemicals found in it, and its source - groundwater, surface water, rainwater or seawater.

The formal definition of wetland in the RMA is:

> **wetland** includes permanently or intermittently wet areas, shallow water, and land water margins that support a natural ecosystem of plants and animals that are adapted to wet conditions.

Key points of this definition are: does not have to be permanently wet; must support a natural ecosystem adapted to wet conditions (i.e. certain types of plants & animals); does not explicitly require an indigenous ecosystem.

This is quite a broad definition and includes places that may not all be widely recognised as a wetland. For example, often a wetland on a farm will just be a low-lying, boggy area – the spot that grows rushes or cutty-grass that you avoid driving the ute through! (See Figure A below). While other wetlands may be quite large and have permanently standing water with raupo, sedges, flax, cabbage trees and other wetland vegetation growing amongst them (see Figure B below).

Figure A:

Figure B:

Why Wetlands matter?

> *"Better management of wetlands is critically dependent on all parties recognising the value of wetlands on the farm, across the district, and within a national and international context."*[1]

Habitat values

Wetlands are important and significant ecosystems that provide habitat for a diverse range of plants and animals, including many rare and threatened species. They provide a major habitat for at least eight species of indigenous freshwater fish as well as frogs, birds and invertebrates. Coastal wetlands are more biologically productive than almost any other ecosystem, providing habitat, breeding areas and food for shellfish, crustaceans, inshore fish and birds. Although wetlands now cover less than 2% of New Zealand's land area, a fifth of native bird species use wetlands as their primary habitat, and not just single wetlands - many bird species rely on a linked series of wetlands on their flyways for resting and feeding.

Ecosystem services

Wetland ecological processes provide an array of ecosystem services, the benefits of which have indirect economic value, including water storage and flood attenuation, waste disposal and water purification, erosion control, water table maintenance and the retention, removal and transformation of nutrients.

Wetland plants trap sediment suspended in water, improving water quality. In riparian areas, their roots hold riverbank soil together, reducing erosion. Nitrogen and phosphorus enter waterways through groundwater, surface run-off and disposal of effluent. Wetland vegetation uses some of these nutrients for growth. Bacteria living in wetland soils absorb and break down nitrogen from farm run-off and leaching, also improving water quality.

Cultural and Social values

Wetlands are traditional taonga for tangata whenua, valued for mahinga kai (e.g. plants such as harakeke (flax) used for weaving; food sources such as tuna (eels), patiki (flounder) and manu (birds); and rongoa (plants used for medicinal purposes)) and as taonga for their spiritual and metaphysical properties, as well as for their historical associations and significance to tribal identity.

Wetlands are also valued by the wider community for their educational, scientific, aesthetic and recreational values.

State of wetlands

Wetlands are under threat the world over from accelerated drainage, land reclamation, pollution and exploitation of wetland species. In NZ, wetlands once covered large areas of the country, but are now some of our rarest and most at-risk ecosystems, with approximately 90% of wetlands lost over the last 150 years. Draining, burning and clearing of vegetation for farmland, together with the

[1] Office of the Parliamentary Commissioner for the Environment, *Boggy Patch or Ecological Heritage*, March 2002

reclamation of wetlands for urban and industrial uses, have been the principal agents of wetland destruction. In 2007, wetlands were identified as one of the national priorities for protection of biodiversity on private land[2].

The national situation is reflected in Canterbury, where freshwater wetlands now cover only about 10% of their former extent. A higher percentage remains in the high country (especially alpine areas), but in the lowlands, inland basins and along the coastal fringes the proportion is lower, in some cases markedly so. Furthermore, wetlands in these areas are relatively more depleted both in quality and extent, making wetlands that remain in these areas even more significant.

A 2010 Environment Canterbury report[3] looked at the historic and current extent of freshwater wetlands in Canterbury, including recent trends in relation to remaining wetlands over the period 1990-2008. (Note that the baseline information for this report was sourced from data that does not include wetlands under 0.5ha in area). This showed that although most of the approximately 2000 remaining wetlands in the region showed no detectable change in area over the monitoring period, there were about 140 wetlands that showed either a significant (>25%) or some (up to 25%) reduction in extent. One wetland had increased in extent. The majority of 'reduced' wetlands are in the western half of the region - in the inter-montane basins and valley floors of the high country, with a smaller number of plains and foothill wetlands showing reduction. The Lees Valley, Ashburton-Heron Basin, Upper Rangitata Valley and Mackenzie Basin all showed the largest examples of wetland reduction, and it was notable that several of the recently reduced wetlands had been identified as nationally important for biodiversity in the Waters of National Importance report[4].

Historic and current (*c.* 2000) area of wetlands, % area loss, and number of current wetlands for the 10 Canterbury Water Management Zones[5]

Water Management Zone	Historic wetland area (ha)	Current wetland area (ha)	% loss	Number of 'current' wetland sites
Kaikoura	3272	208	93.6	34
Hurunui - Waiau	26504	352	98.7	64
Waimakariri	22164	1026	95.4	119
Christchurch - West Melton	4257	73	98.3	20
Banks Peninsula	241	32	86.7	11
Selwyn-Waihora	47272	3102	93.4	340
Ashburton	44891	5871	86.9	581
Orari-Opihi-Pareora	18689	831	95.6	195
Upper Waitaki	20022	7843	60.8	420
Lower Waitaki – South Coastal Canterbury	7621	522	93.2	220
Regional Total	**194934**	**19851**	**89.8**	**2004**

Regional Wetland Database

The recently created Canterbury Regional Wetland Geographic Information System (GIS) database has been compiled from the combination of two core information sources - the Freshwater Ecosystems of New Zealand (FENZ) wetland GIS layer for Canterbury, and the ECan coastal wetland database. Together, these provide the basis for this inventory of the region's wetland habitats.

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[2] MfE and DOC, *Protecting Our Places - National Priorities for Protecting Rare and Threatened Native Biodiversity on Private Land*, April 2007.
[3] Environment Canterbury, *Historic and current extent of Canterbury freshwater wetlands, and recent trends in remaining wetland areas,* June 2010
[4] Ausseil et al., 2008
[5] Environment Canterbury, *Historic and current extent of Canterbury freshwater wetlands, and recent trends in remaining wetland areas,* June 2010, as calculated from Ausseil *et al.* (2008).

The FENZ wetlands GIS layer is focused on freshwater palustrine wetlands and standing waterbodies with a 500 m maximum length. *Palustrine* wetlands are defined as all freshwater wetlands fed by rain, groundwater or surface water, but not directly associated with the open water of estuaries, lakes and rivers. The Canterbury portion of the FENZ wetland layer was developed from existing wetland survey information of the 1980s and 1990s. This was then checked against satellite imagery collected between 1999 and 2003 to complete delineation of wetland extent. The baseline for 'current' wetland extent in FENZ is therefore 1999-2003.

The ECan coastal wetland database is based on results of field survey, mapping and description of the region's coastal wetland vegetation/habitats completed by ECan staff over the period 2004-2011. Fifty-eight ground-surveyed coastal wetland areas are included in this database. A survey-dated description of each wetland, together with assessments of wetland condition, threats and ecological significance is provided in the attributes table.

Collectively, these two sources of information provide a reasonably comprehensive inventory of the location and extent of wetlands for the region. For coastal areas, the information is relatively recent and 'ground-truthed' both in terms of location and extent, and condition, threats and significance. For inland wetlands, based on the FENZ database, the key gaps and limitations are: the exclusion of wetlands less than 0.5ha[6], and the age of the original survey information. This means that FENZ provides a useful basis for a comprehensive regional database, but ground-based survey is still necessary to improve accuracy of wetland delineation, as well as provide more detailed state and trend information on, for example, wetland class, vegetation type and overall ecological condition.

Maps from the regional wetland database showing the location of wetlands across the Canterbury region, and by CWMS water management zone are attached (Attachment 1).

Wetland Survey Programme

ECan has a work programme involving annual field survey and mapping of wetlands. The focus of this programme over recent years has been on coastal wetlands to address a key limitation of the FENZ wetland layer. The system of field survey and database reporting developed for the region's coastal wetland habitats will now be applied to inland freshwater wetlands. Ground-based survey will be carried out to add to, update or improve delineation of wetland areas derived from FENZ, as well as provide a similar level of information on wetland class, vegetation type and overall ecological condition. Results of future wetland survey, ecological description and significance assessment will progressively be added to the regional wetland database.

Field survey work is generally prioritised on the basis of where the greatest development pressures/threats to remaining wetlands are occurring. However, with present resources and on-going issues related to gaining access to wetlands on private land, it is estimated that this programme will take 5-10yrs to cover the whole region.

Regulatory Framework

The RMA definition for wetland is set out above in the first section of this paper. This definition applies in the regional context under the proposed Regional Policy Statement (RPS), the Natural Resources Regional Plan (NRRP), and the proposed Land and Water Regional Plan (LWRP).

RMA

Wetlands are water bodies, just as equally as streams, rivers or lakes. Consequently, wetlands are subject to the core provisions of the RMA that apply to freshwater bodies – ss14 & 15. These provisions provide that you may not do anything that may affect the water quantity or quality (i.e. take, use, dam, divert, drain, discharge) of a freshwater body unless you have a resource consent, or a rule in a regional plan makes it a permitted activity. Thus, the default situation under the RMA is one of regulated control – no wetland drainage or water diversion without resource consent.

[6] Small remnant wetlands have high ecological significance in highly modified landscapes such as the Canterbury Plains, are abundant in parts of the region, and can be important sites for sustaining threatened species like Canterbury mudfish.

This contrasts with the default situation that applies generally to land use activities (including wetland vegetation clearance/modification, or disturbance of the bed of a wetland), which is that you may do anything unless a regional or district plan requires a resource consent for, or prohibits, the activity.

Section 6 of the RMA sets out matters of national importance to be provided for, including the following matters that relate to/could relate to wetlands:
(a) the preservation of the natural character of … wetlands…; and
(c) the protection of areas of significant indigenous vegetation and significant habitats of indigenous fauna.

National Policy

- National Policy Statement for Freshwater Management:
  - Focus on water quality and water quantity
  - Objectives incorporate factors relevant to wetlands:
    - Objective A1: "...safeguard the life-supporting capacity, ecosystem processes and indigenous species including their associated ecosystems of fresh water, in sustainably managing the use and development of land, and of discharges of contaminants."
    - Objective A2: "...overall quality of fresh water within a region is maintained or improved while:
      b) protecting the significant values of wetlands..."
    - Objective B1: "..safeguard the life-supporting capacity, ecosystem processes and indigenous species including their associated ecosystems of fresh water, in sustainably managing the taking, using, damming, or diverting of fresh water."
    - Objective B4: "To protect significant values of wetlands."

Regional Policy & Plans

- Proposed Regional Policy Statement (RPS):
  - Main chapters relevant to wetlands: Ch9 Ecosystems and Indigenous Biodiversity & Ch7 Freshwater
  - Policy 7.3.1 – identification and preservation / maintenance / improvement of natural character values of freshwater bodies, including wetlands
  - Policy 7.3.3 – identify and protect wetlands and other areas of significant ecological value
  - Policy 9.3.1 – protect significant natural areas/habitats (policy includes criteria for determining significance).
  - Policy 9.3.5 – protect values of ecologically significant wetlands; promote protection and restoration of all remaining wetlands; encourage creation of wetlands that contribute to restoration of biodiversity.
  - Policy 9.3.2 - national priorities for protection (includes indigenous wetland vegetation) – maintain the indigenous vegetation and habitats of these areas.

- Natural Resources Regional Plan (NRRP):
  - Ch7 specifically addresses wetlands. It introduces a range of voluntary measures backed up by more focused regulation of wetland hydrology than s14 of the RMA provides for. It sets out procedures for classifying the significance of wetlands and the scope of changes allowed for low, moderate or high significance wetlands, and it enables activities such as restoration, enhancement and creation of wetlands and pest control within wetlands.
  - Rules relating to reduction of wetland area (i.e. damming, diverting, draining) are dependent on whether the wetland has been assessed as being of low, moderate or high significance.
    - If a wetland has been assessed as low significance, the rules are permissive – allowing up to 0.5ha reduction in wetland area.
    - If a wetland has not been assessed, or has been assessed as of moderate or high significance, resource consent is required. Any reduction in area of a moderate or high significance wetland must be offset by the enhancement, restoration or creation of another wetland.

- Ch4 (Water Quality) includes rules relating to discharges. These either restrict direct discharges into wetlands or require a separation distance between the discharge and wetlands.
- Ch4 also includes rules restricting stock access to natural water bodies, including wetlands:
    - All intensively farmed livestock prohibited from all rivers, lakes and wetlands. This applies to: dairy cattle, farmed pigs, any livestock[7] grazed on irrigated land, or break-feeding or strip-grazed on crops adjacent to a natural water body.
    - Cattle, farmed pigs and farmed deer prohibited from all significant salmon spawning reaches or inanga spawning areas.
    - Any other livestock access to water bodies must not have significant adverse effects, including heavy pugging, visible discolouration of water, increase in bacteria levels, or obvious evidence of faecal matter.
- Ch5 (Water Quantity) includes rules relating to the taking, use, damming or diversion of water that may apply to wetlands in addition to those outlined above under Ch7.
- Ch6 (Beds of Lakes and Rivers) includes rules relating to activities within the beds of lakes and rivers and land adjacent to the bed. Ch6 applies to wetlands where the wetland is located within the bed of a lake or river or land adjacent to the bed, i.e. within the interface between the bed and the adjoining land. Conditions in these rules protect moderate or higher significance wetlands.

- Proposed Land & Water Regional Plan (LWRP):
    - Will replace chapters 1 and 4-8 of the NRRP
    - RMA definition of 'wetland' applies, but LWRP frequently refers to 'natural wetland', which is defined as: "a wetland formed by natural geomorphic processes, whether modified by human activity or not, and excludes any artificially made wetland".
    - Relevant objectives (3.6, 3.7 & 3.8) aim to:
        - protect the significant indigenous biodiversity values of natural wetlands & hapua
        - enhance the overall stock of wetlands in Canterbury that contribute to cultural and community values, biodiversity, water quality, mahinga kai or ecosystem services
        - maintain or restore the mauri of freshwater bodies (including natural wetlands)
        - maintain or enhance the health of ecosystems in freshwater bodies (including wetlands)
    - Key policies provide:
        - Wetlands located in the beds and margins of lakes and rivers managed as part of the lake or river rather than as separate wetlands (not subject to wetland-specific rules)
        - Any take, use, damming or diversion of water, any discharge, or any earthworks, structures, planting, vegetation removal or other land uses within a natural wetland boundary, must not adversely affect the significant indigenous biodiversity values of natural wetlands, except for temporary and minor effects associated with infrastructure installation/maintenance, pest management or habitat restoration/enhancement
        - Modification of natural wetlands may occur if necessary to provide for the installation of infrastructure and any significant effects are offset by other improvement or expansion of the same wetland
    - Provisions relating to discharges generally apply to wetlands
    - Stock exclusion provisions as per NRRP
    - Enhancing, restoring, creating of wetlands is permitted (subject to conditions)
    - Reduction of area of natural wetlands:
        - restricted discretionary activity where is for provision of infrastructure (includes dam, divert, drain);

[7] Includes cattle, sheep, deer, horses, pigs, goats, llama, alpacas

        - non-complying activity where is for any other purpose (includes dam, divert, drain, vegetation clearance, burning or earthworks)
    - Restrictions on earthworks, vegetation clearance and cultivation within setback distances of waterbodies, including natural wetland boundary
    - Restrictions on burning of vegetation within prescribed distance of wetlands
    - Farm Management Plans required for certain farming activities must address wetland management

City and District Plans also often contain provisions regulating land use activities that impact upon wetlands.

Non-Regulatory Programmes

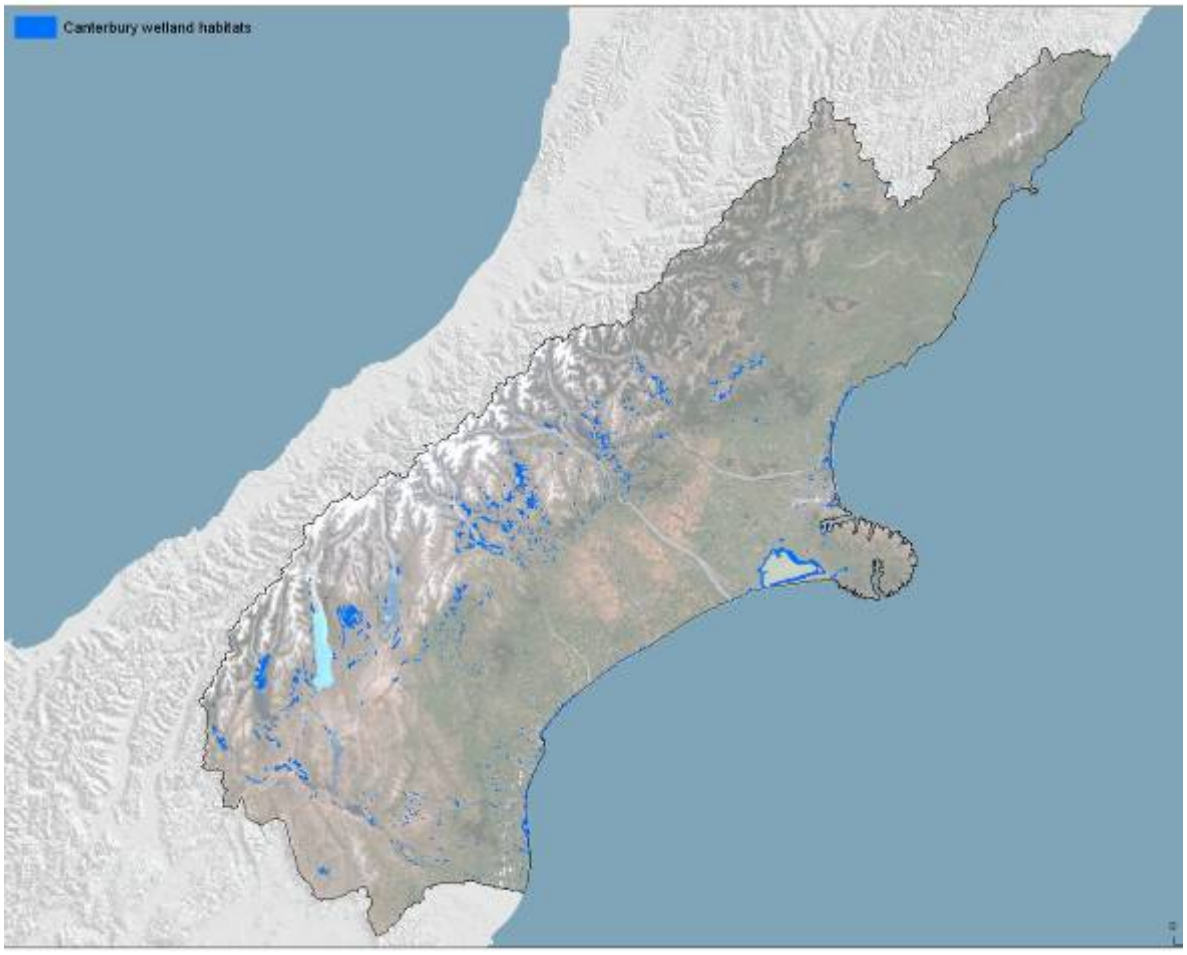
Running in parallel to the regulatory framework, and the database and survey programmes outlined above, ECan has a number of non-regulatory initiatives that contribute to the protection and restoration of wetlands. The focus of these initiatives is on achieving action on the ground that supports biodiversity protection and restoration. A key component is the increased and dedicated team of biodiversity officers, who work 'on the ground' with landowners, communities, iwi, NGOs and other agencies to provide advice, support and information about biodiversity, including wetland management. The biodiversity team also administers several incentive funds (including the Immediate Steps programme and Environmental Enhancement Fund), totalling close to $2 million per year from ECan to support biodiversity protection and restoration in the region. Many of the projects funded relate to wetlands, and many of the priority areas identified by zone committees for the Immediate Steps programme include wetlands.

A range of information, advice and guidance related to wetlands is also available on ECan's website, as well as in various publications, pamphlets, fact sheets etc. that ECan produces. Some key ones include:

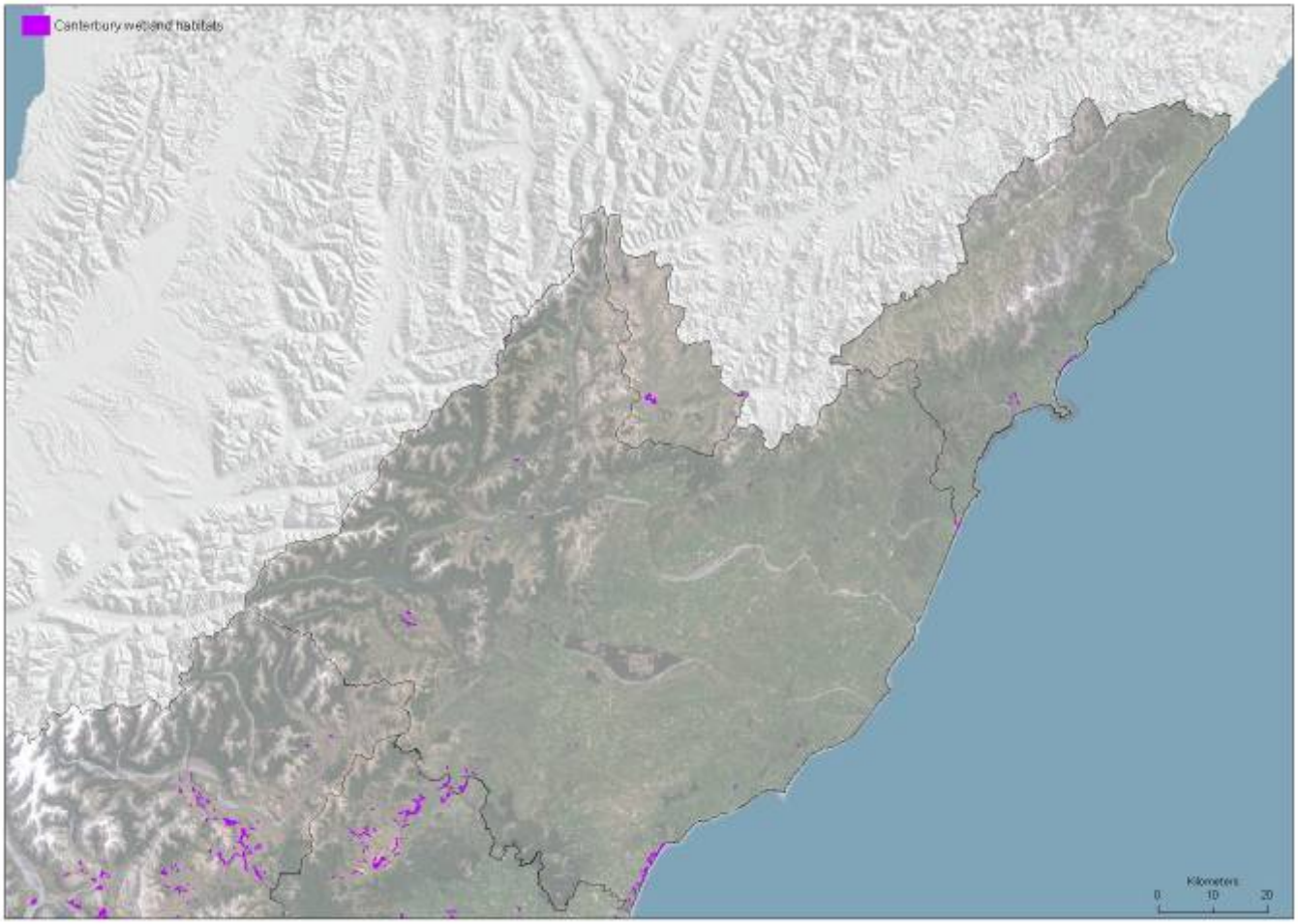
- Info Sheet 11 "Wetlands: What are they?" http://ecan.govt.nz/publications/General/infosheet11Wetlands.pdf
- Wetland planting guide http://ecan.govt.nz/publications/General/what-to-plant.pdf
- Riparian management guide http://ecan.govt.nz/publications/General/RiparianZonesWetlandsE0470.pdf
- Waterway management guide http://ecan.govt.nz/publications/General/Managingwaterways.pdf

Attachment 1

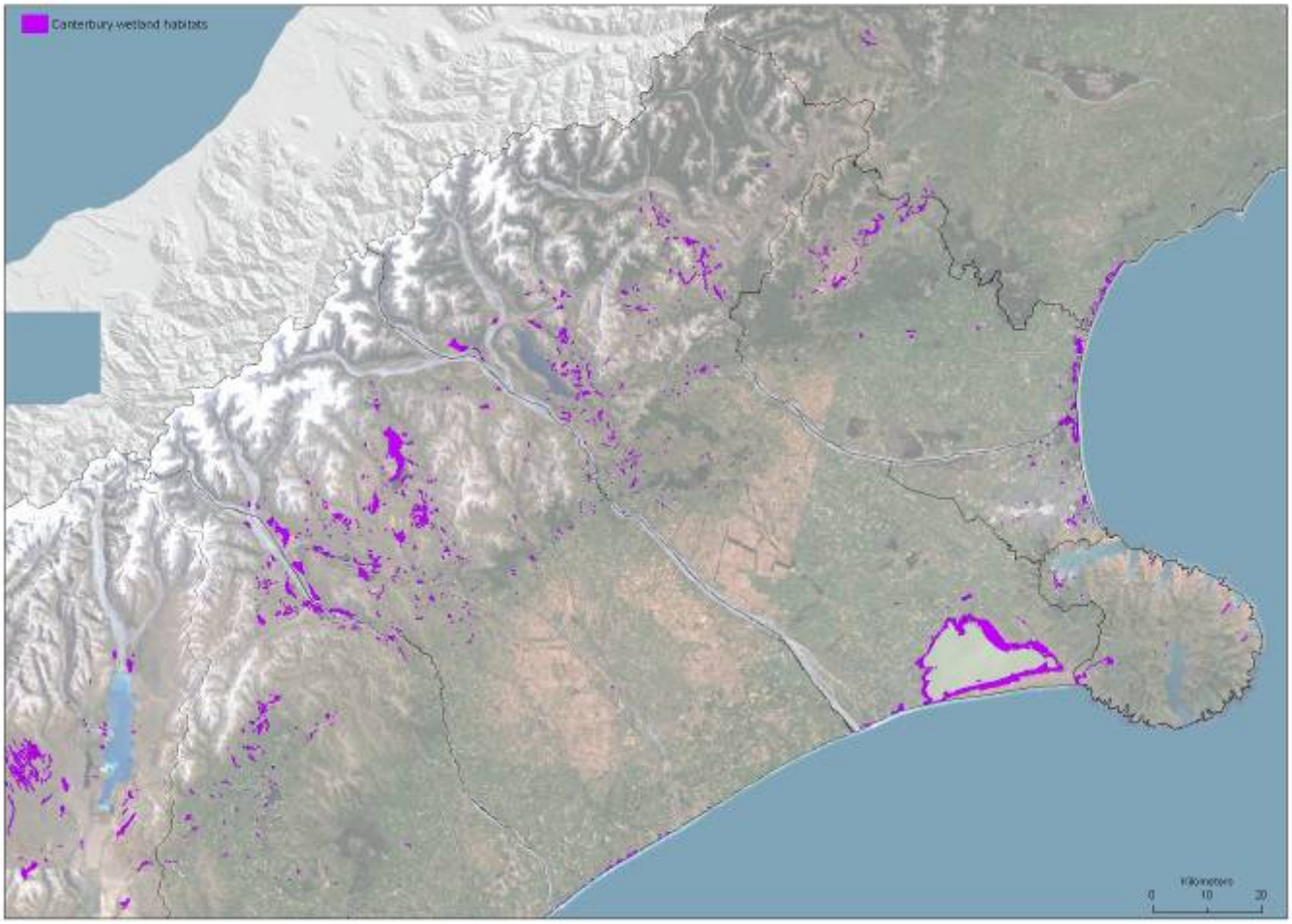
Wetland location and extent – Canterbury region



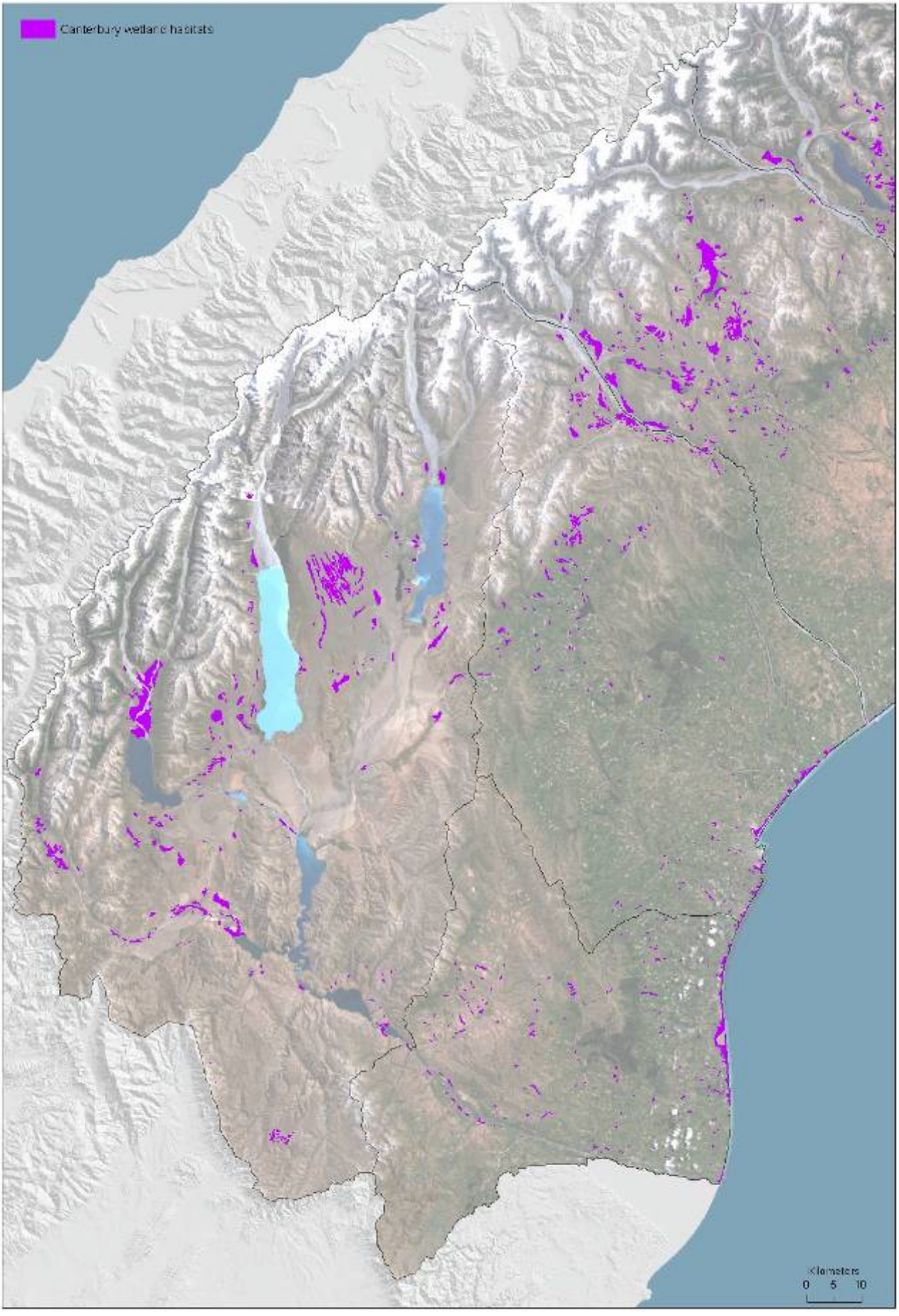
Wetland location and extent – Kaikoura and Hurunui-Waiau water management zones



Wetland location and extent – Waimakariri, Christchurch-West Melton, Banks Peninsula, Selwyn-Waihora and Ashburton water management zones



Wetland location and extent – Orari-Opihi-Pareora, Lower Waitaki-South Coastal Canterbury and Upper Waitaki water management zones



9. INDIGENOUS BIODIVERSITY HABITAT ANALYSIS 7.50PM TO 8.20PM

AGENDA ITEM NO: 9		**SUBJECT MATTER:** Indigenous biodiversity habitat analysis
REPORT:	Christchurch West Melton Zone Committee	**DATE OF MEETING:** 23 August 2012
REPORT BY:	Mimouk Hannan Environment Canterbury	

PURPOSE

This agenda item is for the Zone Committee to review the working draft ZIP content related to indigenous biodiversity, on the basis of additional analysis provided by an expert panel on Indigenous biodiversity habitats.

BACKGROUND

The Zone Committee are asked to identify gaps, omission, additions, to working draft ZIP content based on the additional analysis.

ATTACHMENTS

- Indigenous biodiversity habitat analysis (draft version) to be tabled.

10. WORKING DRAFT ZIP (REVISED CONTENT) 8.20PM TO 8.50PM

AGENDA ITEM NO:	**SUBJECT MATTER:** Working Draft ZIP (Revised Content)
REPORT: Christchurch West Melton Zone Committee	**DATE OF MEETING:** 23 August 2012
REPORT BY: Matthew Ross, Facilitator	

PURPOSE

This agenda item is for the Zone Committee to discuss and comment on the further development and revised content of the working draft Zone Implementation Programme since the last public meeting.

BACKGROUND

The Zone Committee has held 4 informal workshops to further develop possible key principles, priorities, and outcomes for the draft Zone Implementation Programme since the last public meeting. The output from these workshops has been reworked by the Facilitator for discussion and comment at the public meeting.

The Zone Committee are asked to highlight any significant points for further consideration in the drafting of the Zone Implementation Programme at the scheduled workshop sessions.

In particular the Zone Committee are asked to consider:

Whether the key principles will be implemented effectively by the priority outcomes in other areas
Are there significant gaps or omissions in the ZIP when compared with the Priorities, Principles, and Targets of the CWMS.

The Zone Committee are asked to agree the reworked content as the working draft Zone Implementation Programme that will be used for targeted early engagement.

ATTACHMENTS

- Reworked version of the possible draft ZIP to be tabled.

11. WORK PROGRAMME TO ZIP 8.50PM TO 9PM

AGENDA ITEM NO: 11	**SUBJECT MATTER:** Work Programme to ZIP
REPORT: Christchurch West Melton Zone Committee	**DATE OF MEETING:** 23 August 2012
REPORT BY: Matthew Ross, Facilitator	

PURPOSE

Agenda item is for the Zone Committee to note the updated work programme to producing the Zone Implementation Programme (ZIP).

ATTACHMENTS

- Work Programme as of 23 August 2012 (**attached**).

CHRISTCHURCH-WEST MELTON ZONE COMMITTEE
DRAFT WORK PROGRAMME, AS OF 23 AUGUST 2012

Date / Event	*Content*
24/25 Aug *Youth hui*	*Next generation decision makers "zone committee" workshop*
30 Aug *ZIP workshop 8*	*Refining working draft ZIP content* *Consider Youth hui feedback* *Consider early engagement feedback*
05 September *ZIP workshop 9*	*Refining working draft ZIP content*
14 September	*Joint Waimakariri River Workshop with Selwyn Waihora Zone, Waimakariri Zone, Regional Committee*
27 Sept **Public meeting 11**	• **Receive Youth hui feedback** • **Presentations on topics not covered prior to May 2012 and new topics identified from workshops** • **Confirm draft ZIP1.1 for engagement and consultation process**
October 2012	*ZIP engagement and consultation period inc:* *Community and stakeholder meetings* *Electronic/written submissions*
25 Oct **Public meeting 12**	***Items that need to be addressed / considered further*** ***Additional content***
November 2012	*Ongoing ZIP engagement and consultation period* *Collate and consider responses* *Recommended changes to draft ZIP developed*
28 Nov **Public meeting 12**	**Consider recommended updates to draft ZIP.** **Confirm ZIP1.1**
December 2012	*Formally present ZIP1.1 to CCC, SDC, Environment Canterbury*
Feb 2013 *Public meeting 13*	*Receive implementation responses/project schedules from key delivery organisations*
March 2013 *Public meeting 14*	
April 2013 *Public meeting 15*	
May 2013 *Public meeting 16*	
June 2013 *Public meeting 17*	*Confirm ZIP1.2*

12. WAIMAKARIRI RIVER AND CHRISTCHURCH AQUIFER INTERACTIONS 9PM TO 9.30PM

AGENDA ITEM NO:	**SUBJECT MATTER:** Waimakariri River and Christchurch Aquifer Interactions
REPORT:	**DATE OF MEETING:** 23 August 2012
REPORT BY: Francis Pauwels, Programme Director, CWMS	

PURPOSE

Paul White of GNS Taupo will address the Committee on his knowledge of the interactions between the Waimakariri River and the Christchurch Aquifers / Groundwater Protection Zones.

ATTACHMENTS

- Background paper for information to be separately circulated.

Groundwater-surface water interaction and the Waimakariri River, Canterbury.

Paul White and others (GNS Science)

ACKNOWLEDGEMENTS

• Data collection by Environment Canterbury has been the key to this project. Particularly, the efforts of the following staff for providing data are really appreciated: Bryan Todd, Marc Ettema, Tony Gray, Phil Abrahams and Bill Mecchia. Thanks also to Kathleen Crisley for supporting this project.

•Our thanks to the organisations that provided funding to this project, to: NIWA for providing part funding through their groundwater ecology programme (FRST contract C01X0503, Programme Leaders Mike Scarsbrook and Graham Fenwick); and GNS Science for providing part funding through groundwater research projects.

•

•NIWA staff also contributed to this paper, and their contributions are gratefully acknowledged including: Ross Woods, for supplying a rainfall map, Julian Sykes for collecting Waimakariri River samples and Mike Crump for analysing Waimakariri River samples.

•Our thanks also go to GNS Science staff for science work on this project (Gil Zemansky and Stew Cameron) and to Connie Tschritter, Samatha Alcaraz and Sue Shaw.

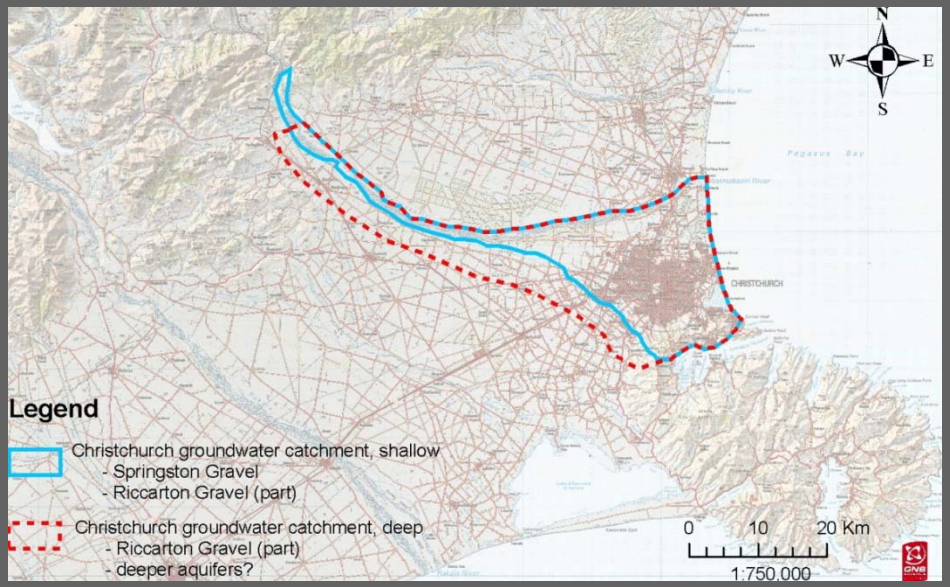
INTRODUCTION

- The Waimakariri River provides most of the groundwater to Christchurch
- This talk summarises research I, and others, have completed in the last approx 10 years to understand groundwater - surface water interaction and the Waimakariri;
- The talk will also cover, somewhat, the importance of the river to Chch groundwater

Why study Christchurch groundwater?

- **Economically, the most important aquifer system in New Zealand with an economic value in the billions.**

- **Highest economic value in New Zealand for domestic supply ($60 M/yr) and for industrial use ($2.3 B/yr).**



Intro to speaker: my groundwater publications etc re Chch groundwater

•White, P.A., Hong, Y-S., Murray, D., Scott, D.M. Thorpe, H.R. 2003. Evaluation of regional models of rainfall recharge to groundwater by comparison with lysimeter measurements, Canterbury, New Zealand. Journal of Hydrology (NZ) 42(1), 39-64.

•Kerr, G.N., Sharp, B.M.H., White, P.A. 2003. The economics of augmenting Christchurch's water supply. Journal of Hydrology (NZ) 42(2) 113-124.

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•White, P.A.; Zemansky, G.; Hong, T.; Moreau-Fournier, M. 2010. Geology, groundwater flow and groundwater chemistry of Springston Formation sediment between the Waimakariri River and Christchurch City, GNS Science Report 2009/42 136 p.

•Zemansky, G., Hong, T., White, P., Song, S., Timar, L., Thorstad, J. 2010. Framework for assessment of climate change impacts on New Zealand's hydrological systems. GNS Science report 2010/57 263p.

•White, P.A. Kovacova, E., Jebbour, N., Tschritter, C. 2011. Waimakariri River bed and groundwater - surface water interaction. GNS Science report 2009/41. 71p.

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• Cox, S.C., Rutter, H.J., Sims, A., Horton, T.W., Manga, M., Ezzy, T., Weir, J.J., Scott, D., White, P.A. Hydrological effects of the Darfield (Canterbury) M_w7.1 earthquake, 4 September 2010, New Zealand. Accepted for publication, special issue of NZJGG on the Darfield earthquake.

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•White, P.A., Hong, Y-S., Murray, D., Scott, D.M., Thorpe, H.R. 2002. Modelling of regional rainfall recharge to groundwater, Canterbury Plains, New Zealand. Western Pacific AGU conference, Wellington.

•White, P.A., Stewart, M.K., Reeves, R.R. 2003. Groundwater residence times in Canterbury. Annual conference of the New Zealand Hydrological Society, Taupo. 19-21 November.

•White, P.A. 2005. Catchment of Avon River springs, Christchurch City. Annual conference of the New Zealand Hydrological Society and International Association of Hydrogeology, Auckland. 28 November – 1 December.

•White, P.A., Weeber, J.H., Pamer, R. 2007. Springston Formation gravels and the Christchurch groundwater system. New Zealand Hydrological Society, Rotorua, 21-23 November 2007.

•White, P.A., Weeber J.H. 2007. Chronology of Holocene Springston Formation gravel deposition under Christchurch City. Joint Geological Society of New Zealand and New Zealand Geophysical Society Conference, Tauranga, 27-29 November 2007.

•Zemansky, G.M., White, P.A., Hong, T., Scarsbrook, M. 2007. Defining the groundwater-surface water system: Christchurch, New Zealand case study. Securing Groundwater Quality in Urban and Industrial Environments; 6th International IAHS Groundwater Quality.

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- White, P.A. 2008. Snow and groundwater recharge in Canterbury. Annual meeting of the Snow and Ice Research Group, New Zealand, Cass, 4th – 6th February.
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- White, P.A., Goodrich, K., Cave, S., Minni, G. 2007. Waterways, swamps and vegetation of Christchurch in 1856 and baseflow discharge in Christchurch City streams. GNS Client report 2007/103 to Environment Canterbury. Environment Canterbury report U07/39.
- White, P.A., Weeber, J.H., Pamer, R., Minni, G., Cave, S. 2007. Identification of Springston gravel lobes in the Christchurch Formation. GNS Client report 2007/195 to Environment Canterbury. Environment Canterbury report U07/38.
- White, P. A. 2008. Riccarton Formation, Burnham Formation and Windwhistle Formation lithologies in the vicinity of Christchurch City. GNS Science report 2008/157 for Environment Canterbury.
- White, P.A., Della Pasqua, F. 2008. Riccarton Formation, Burnham Formation and Windwhistle Formation lithologies west and northwest of Christchurch City. GNS Science report 2008/169 for Environment Canterbury.
- White, P.A. Geology and vertical groundwater flow, Central Plains Canterbury. GNS Science report 2008/187 for Environment Canterbury.
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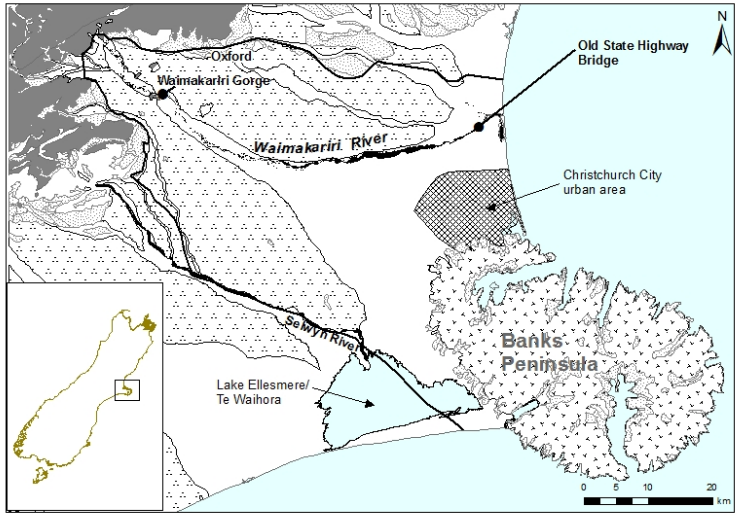
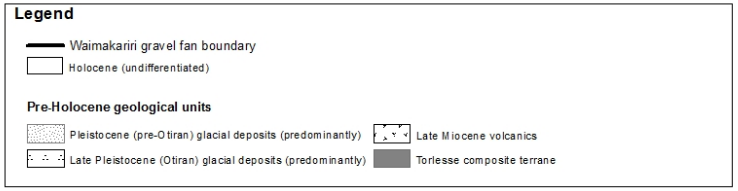
OUTLINE OF TALK

- Introduction to the area and geological context: the Waimakariri gravel fan
- Assessment of groundwater – surface interaction in the Waimakariri River
- Application of results: effects on the river and groundwater of increasing water use

Geological context of groundwater – surface water interaction

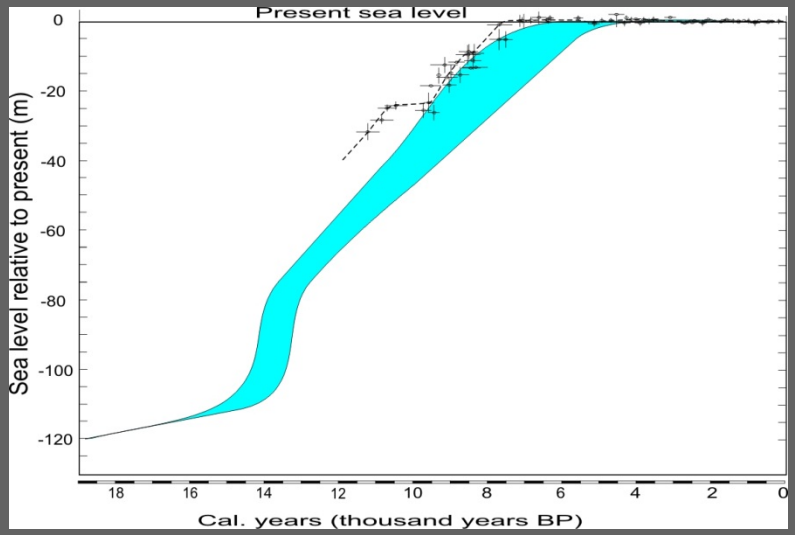
Waimakariri gravel fan
- large gravel fans have formed in the Canterbury Plains over the Pleistocene

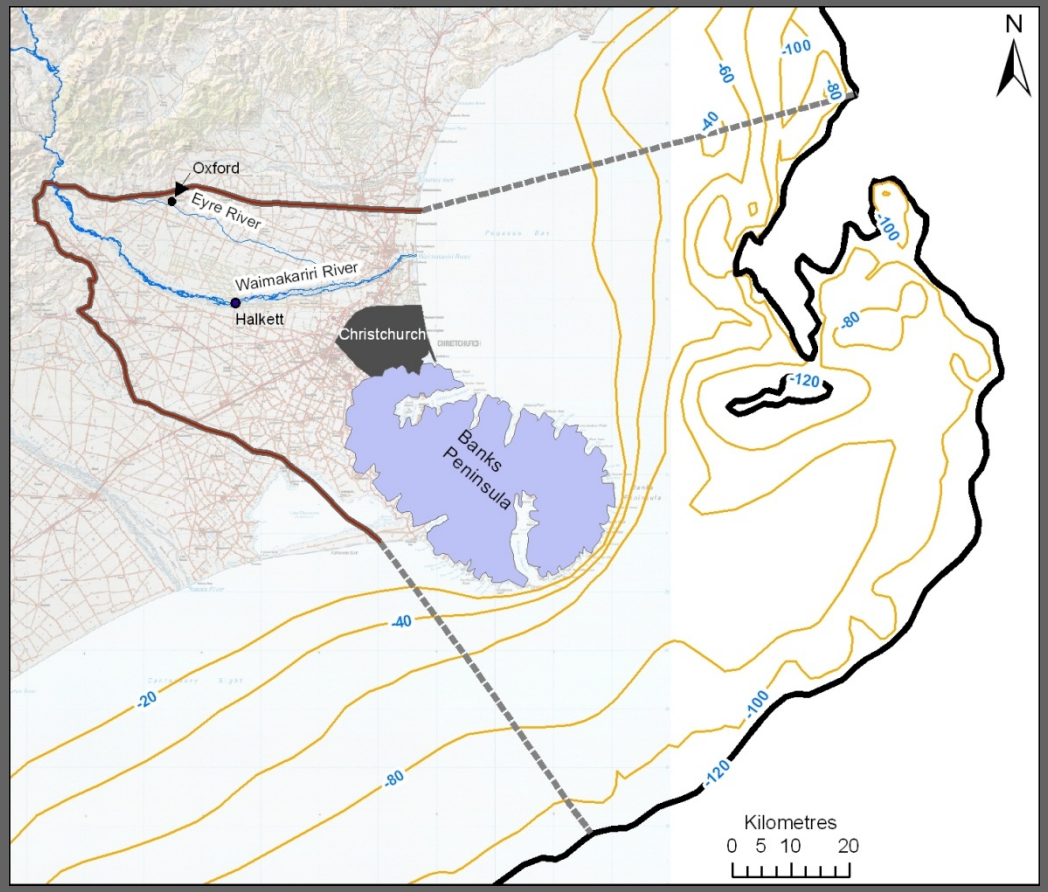




Geology and Christchurch groundwater

Waimakariri gravel fan - extended a long way off shore at the end of the Pleistocene

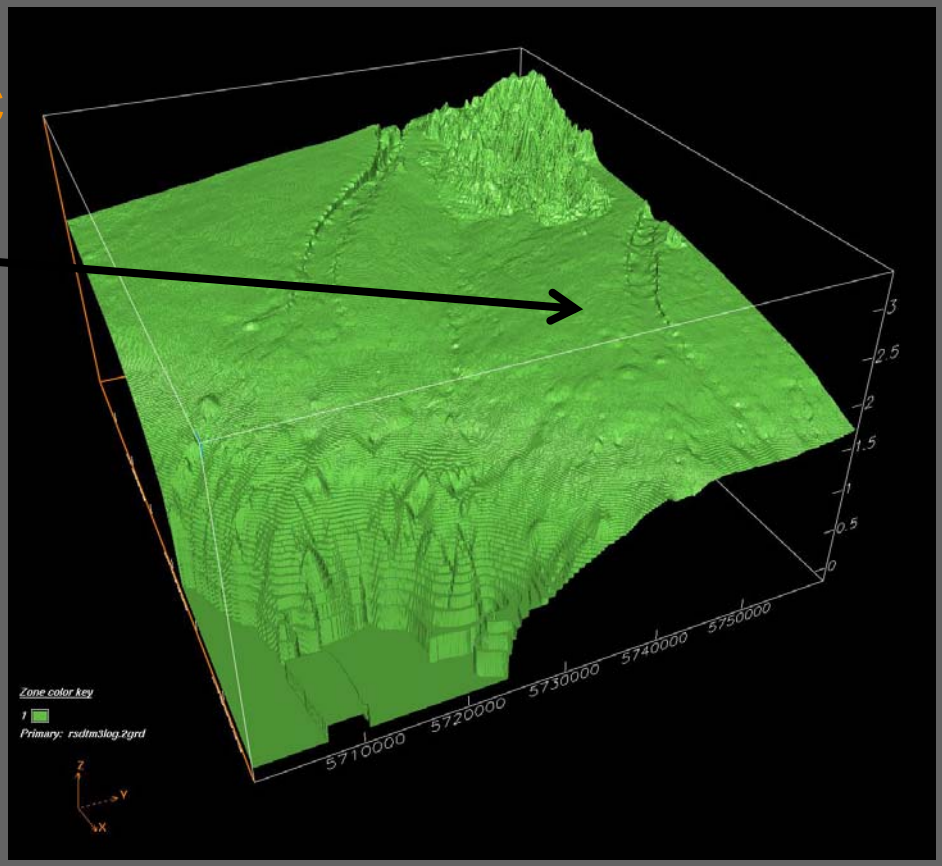


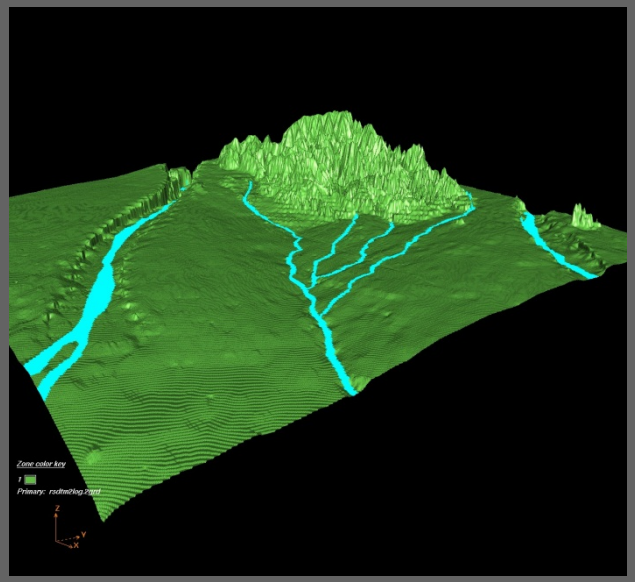


Sea level in Tahiti since late Pleistocene (Bard et al. 1996) ;
Sea level rise in New Zealand in the Holocene (Gibb 1986)

Geological context of groundwater – surface water interaction

Waimakariri gravel fan - the primary geomorphic unit

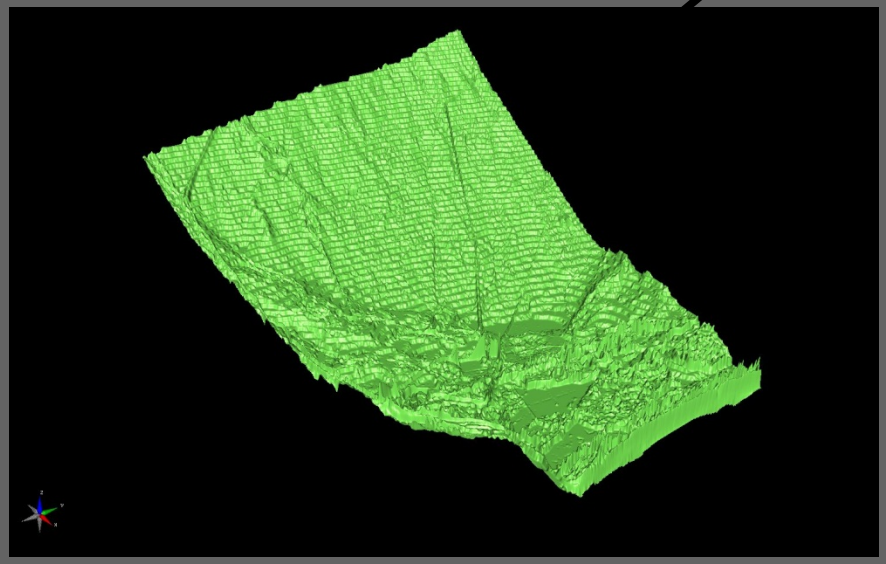


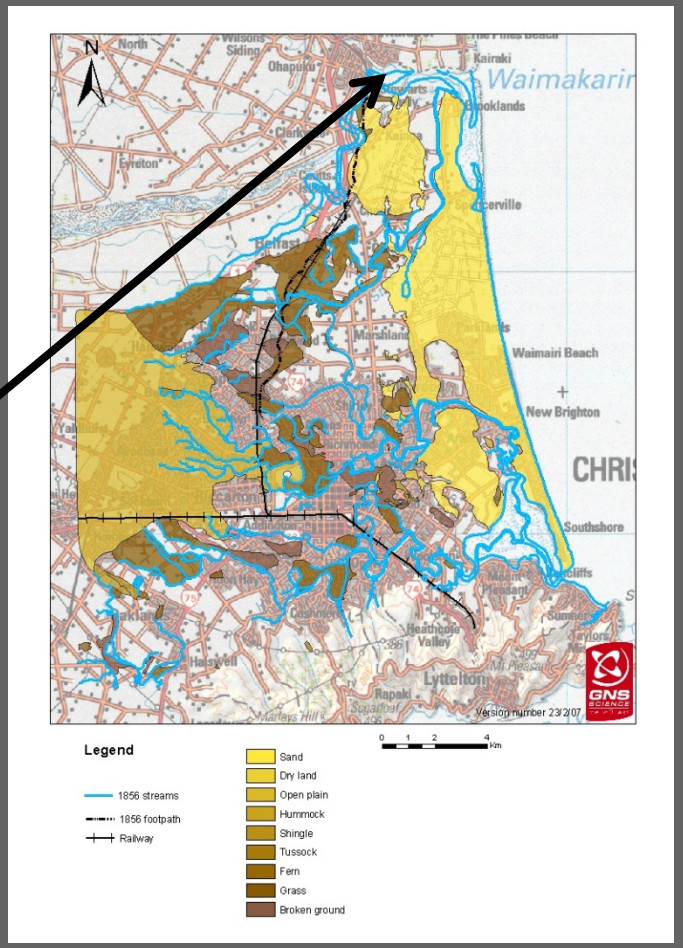


River history and context of groundwater – surface water interaction

Waimakariri River, in European times

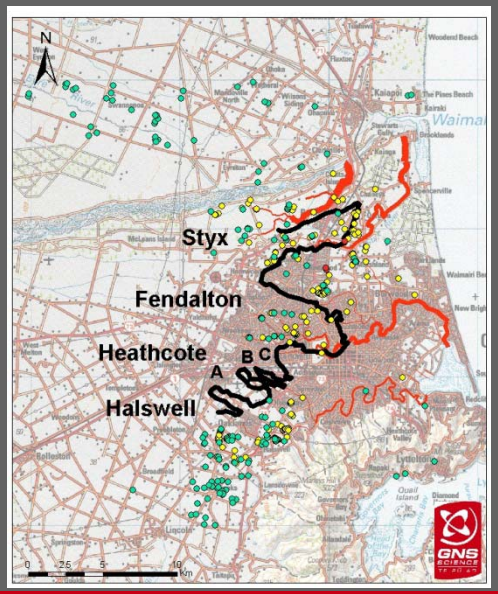
- the river has flooded through Christchurch City
- significant river control works include stop banks and cuttings to control river flow
- historic channel different from current channel

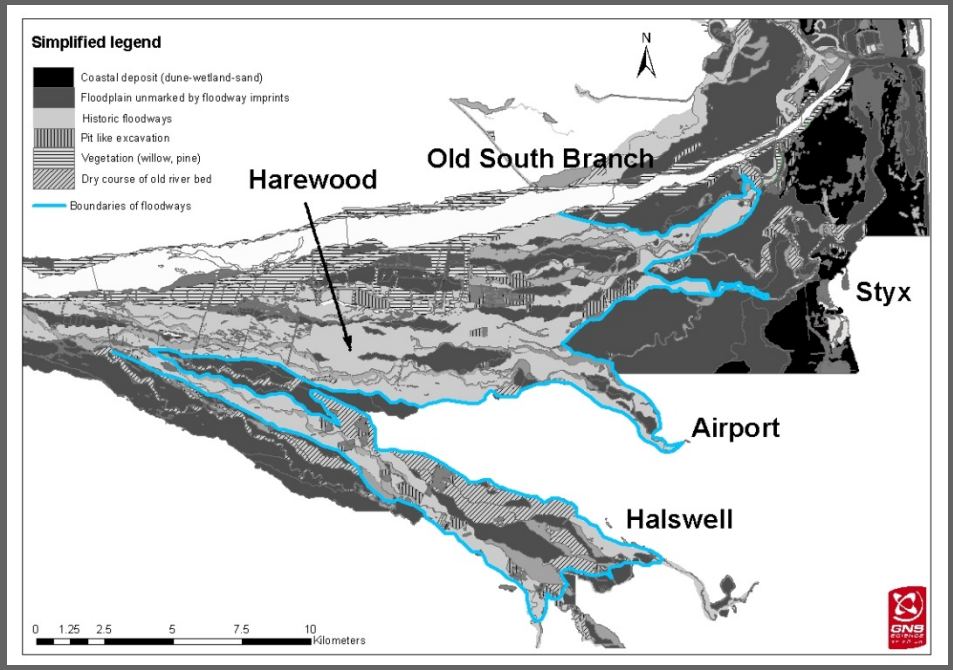




Waimakariri River, in pre-historic times

- river channels have been through Christchurch City
- gravel deposits have been left behind
- these features are an important control on the location of springs and streams

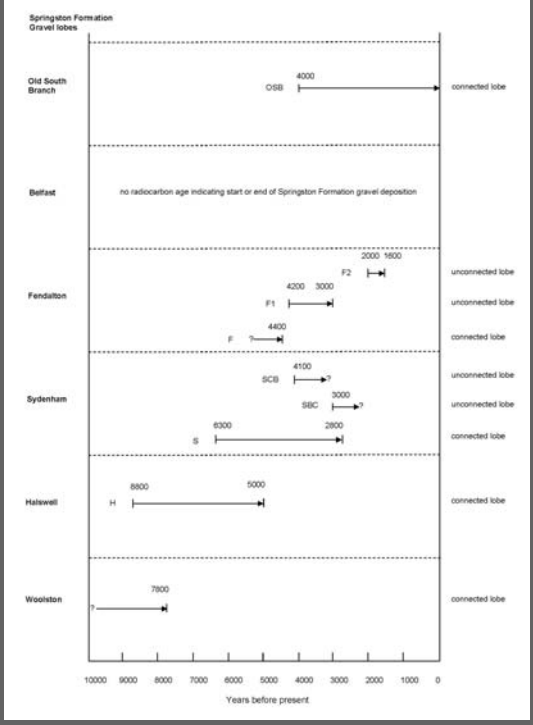




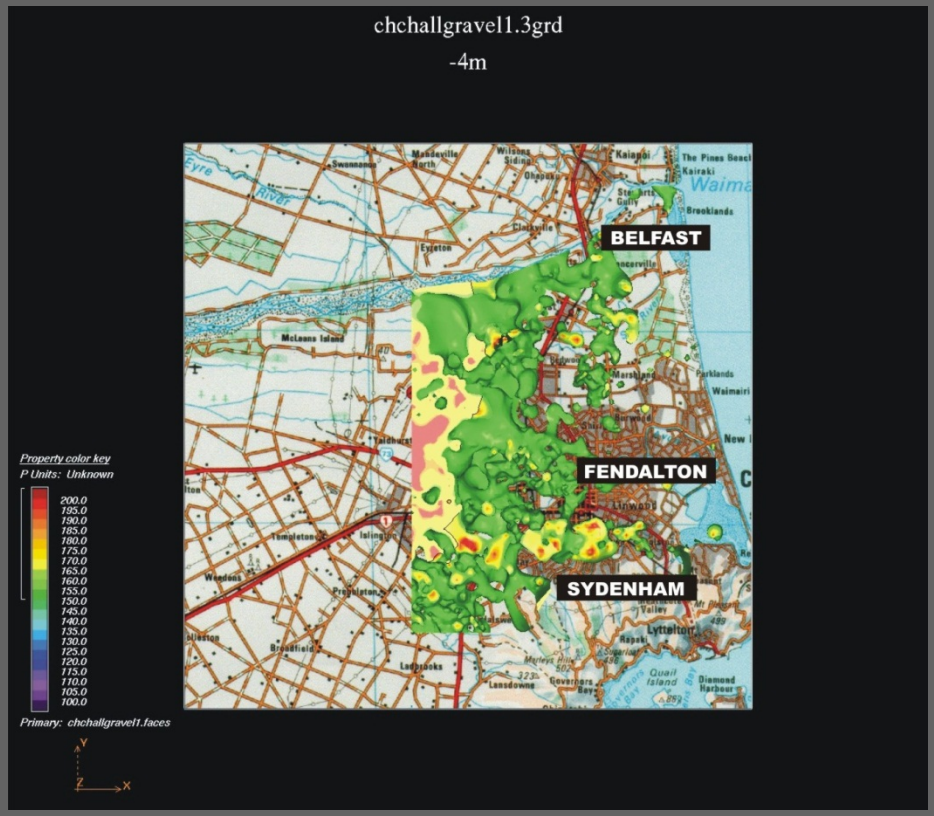
River history and context of groundwater – surface water interaction

Waimakariri River, in pre-historic times

- river channel are identified by 3D geological modelling
- river channel ages identified by radiocarbon dates



3D geological model



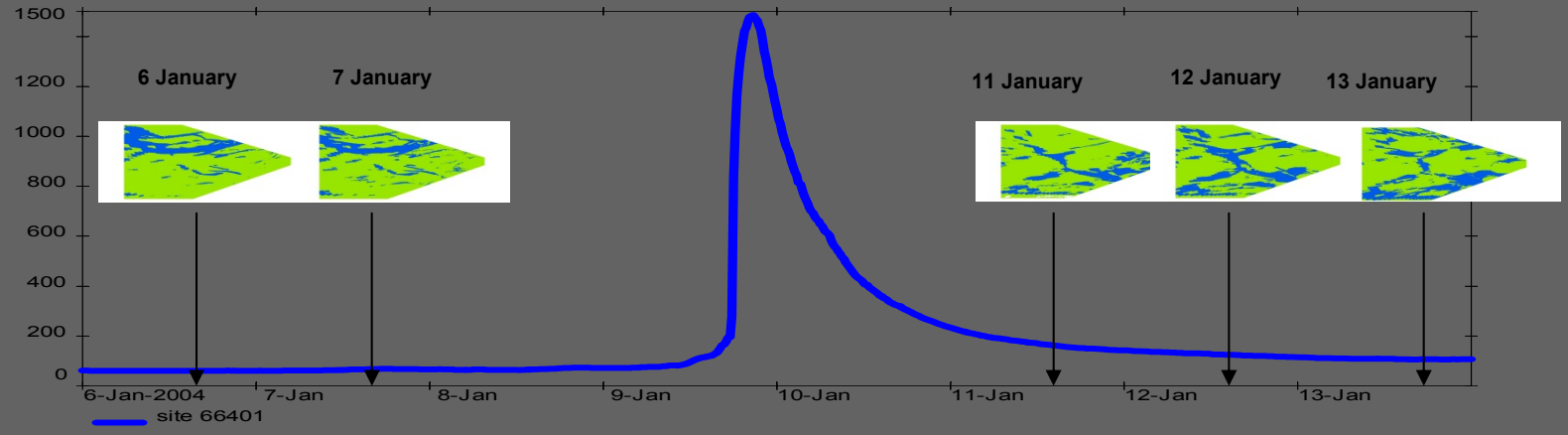
Waimakariri River characteristics: channel and flow

Braided Waimakariri River

Width of river bed up to 1500 m

Mean flow 120 m^3/s

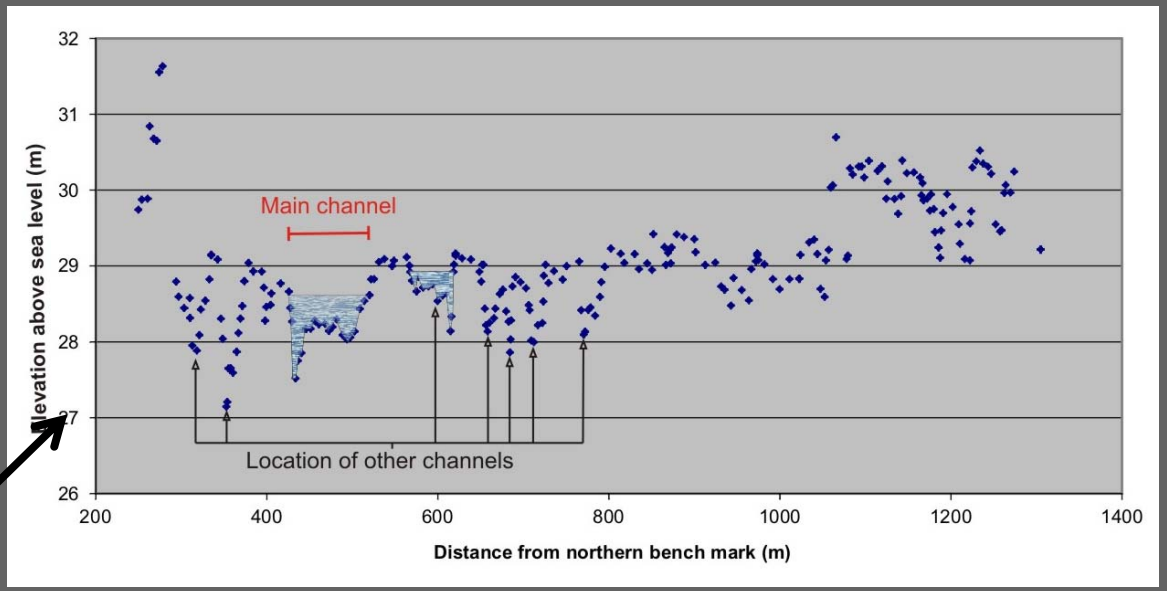
Flood flow up to 1500 m^3/s

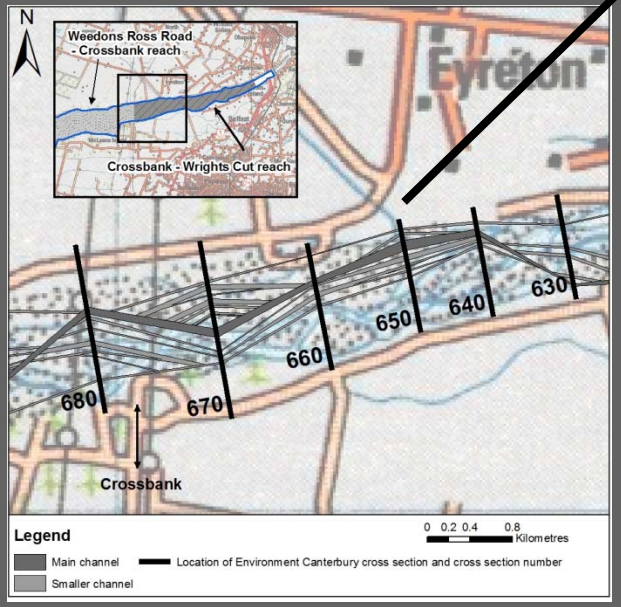


Waimakariri River characteristics: channels

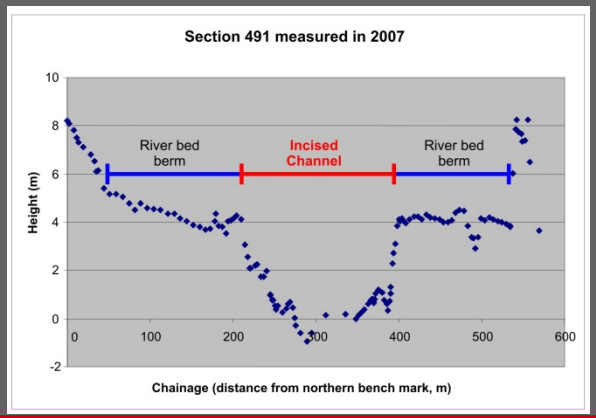
Section 650

Channel positions measured by cross sections at low flow



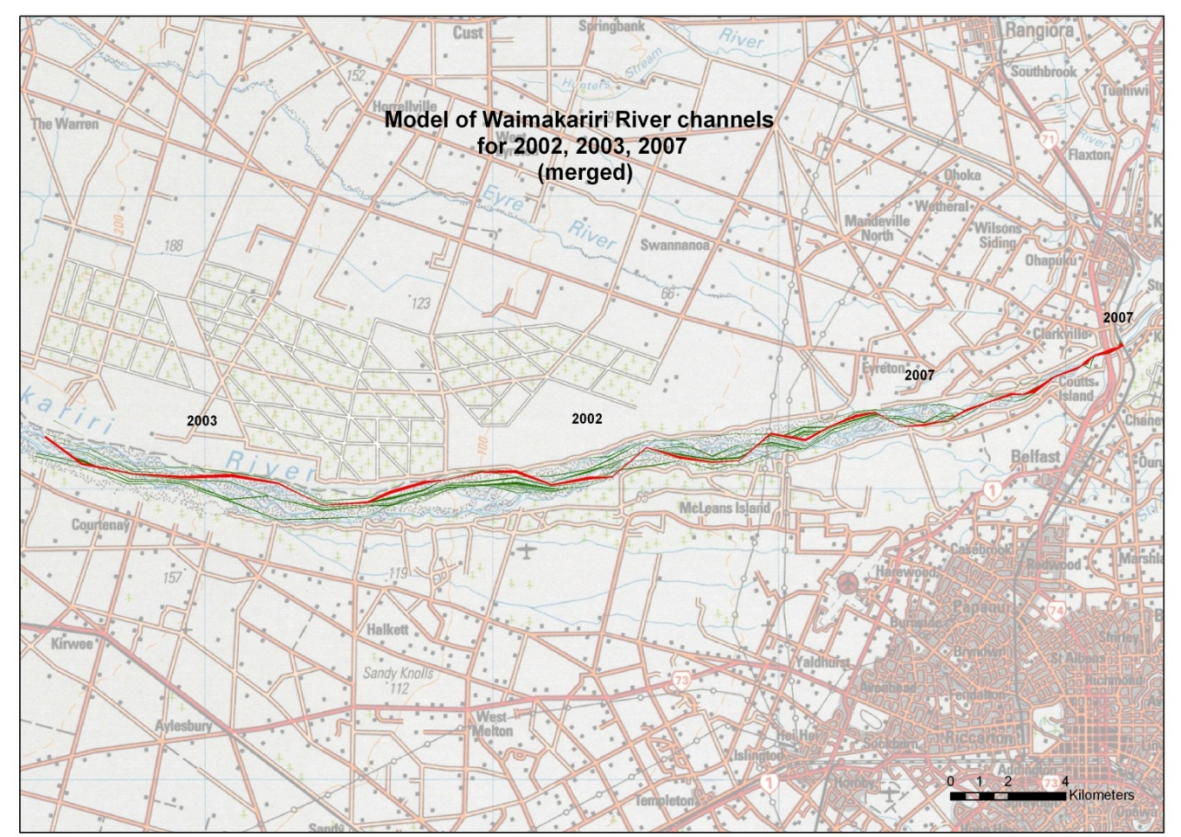


Lower reaches



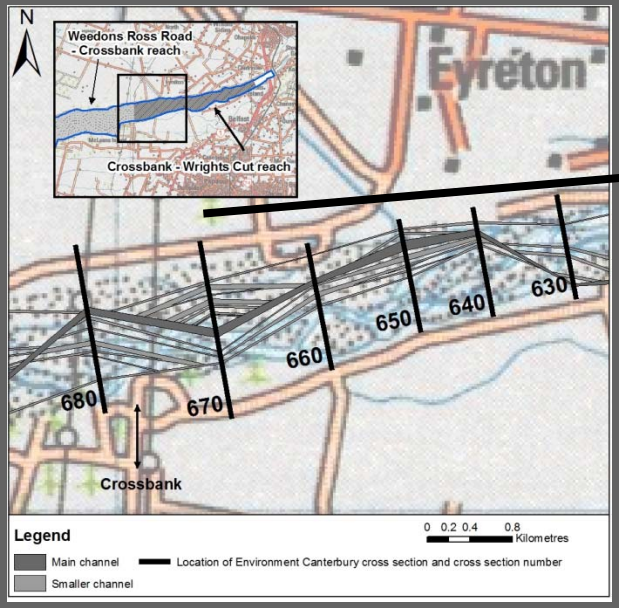
Waimakariri River characteristics: channels

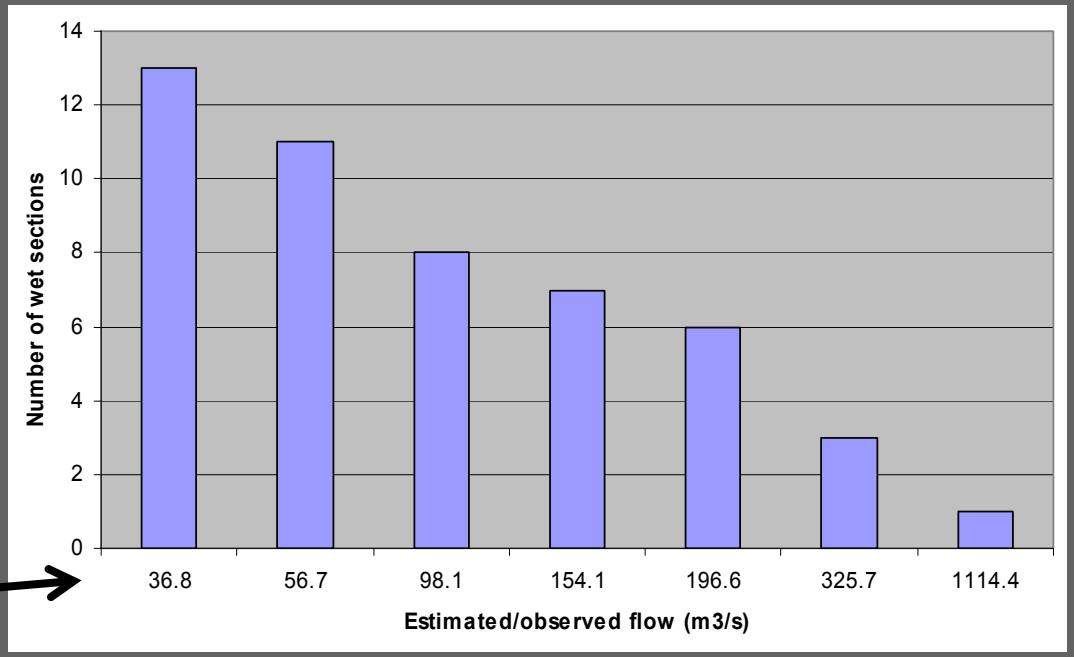
Main (red) and minor channels



Waimakariri River characteristics: channels

Channel number varies with flow

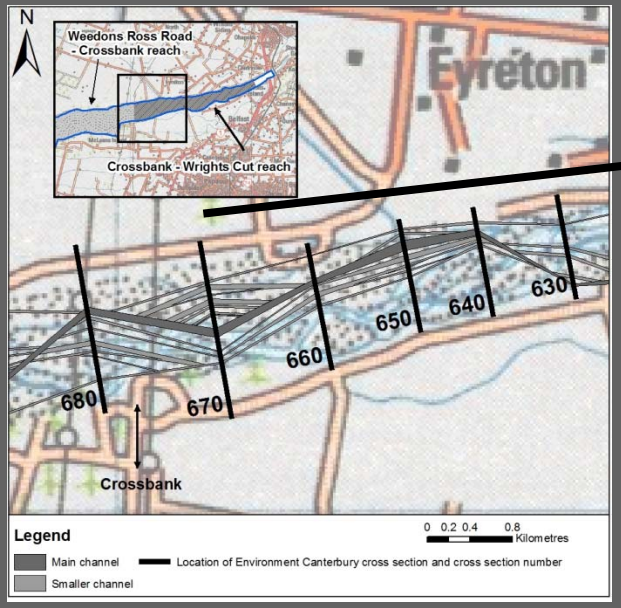


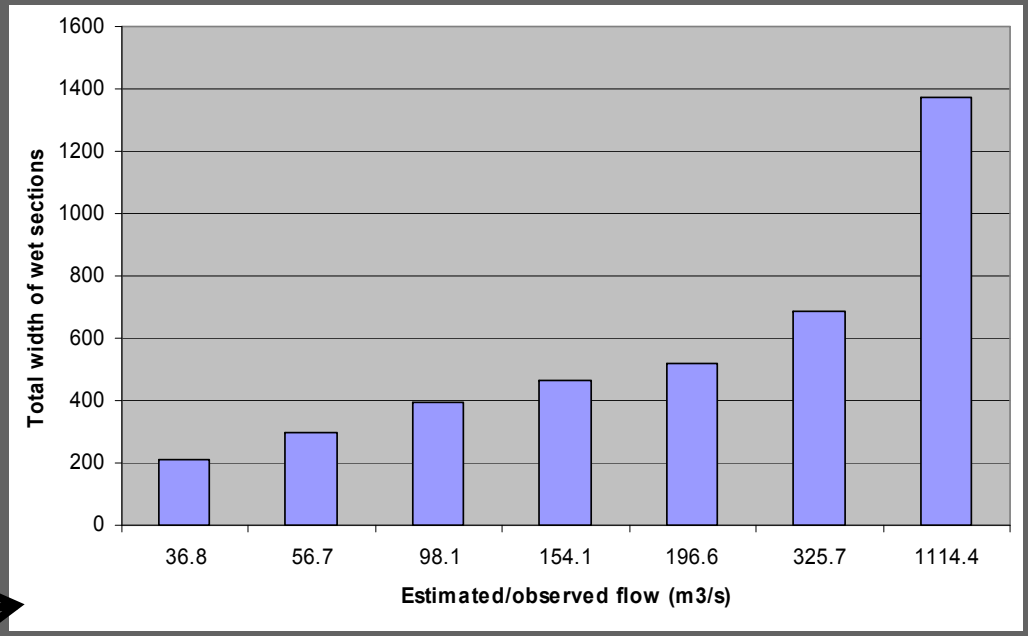


Section 670

Waimakariri River characteristics: channels

Channel width varies with flow



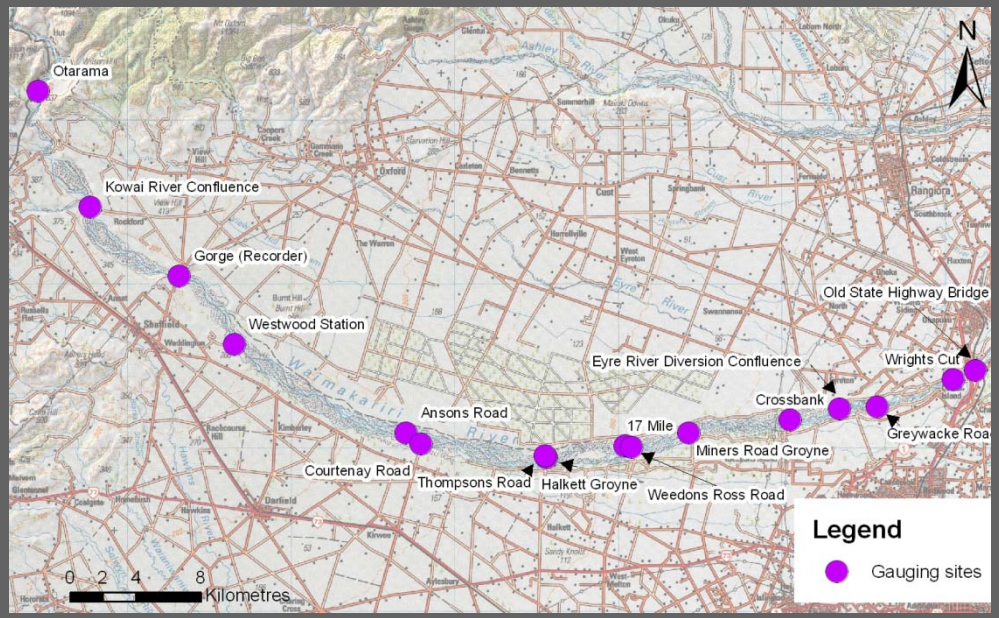


Section 670

Waimakariri River characteristics: river flow

River flow measured occasionally by gaugings at low flow

Flow measured continuously at Old State Highway Bridge



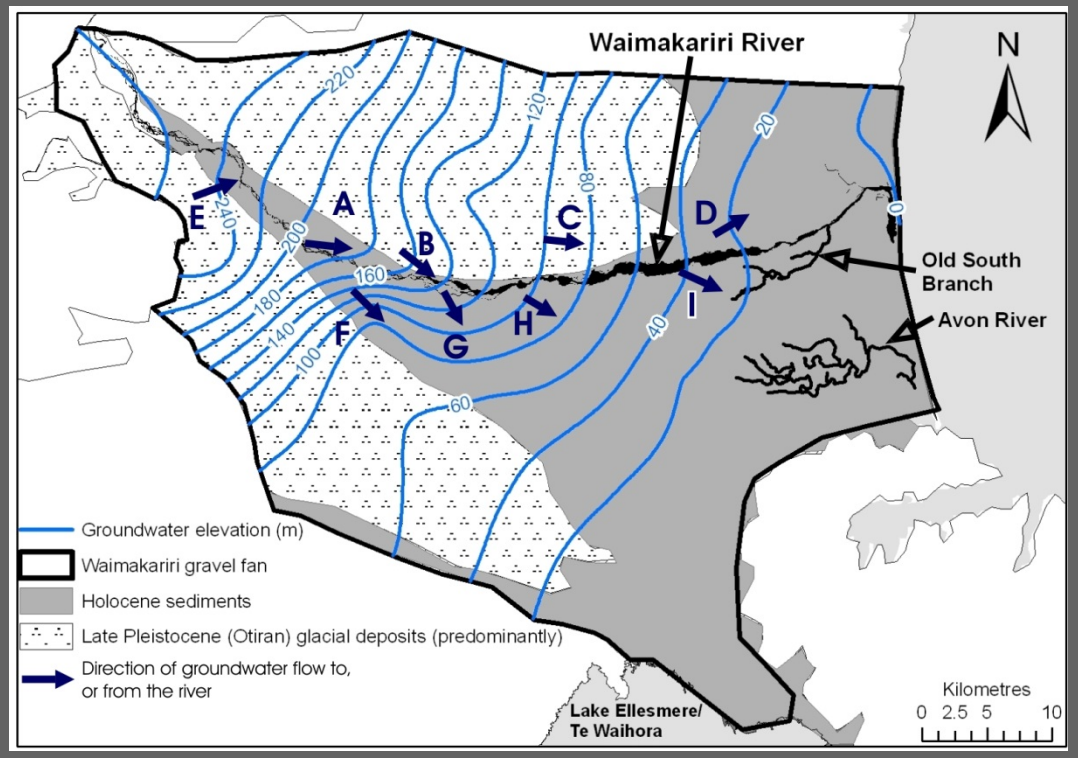
Gauging sites

Broad scale groundwater – surface water interaction

The Waimakariri gravel fan and the Waimakariri River

Summer piezometric contours, and river level in Environment Canterbury cross sections indicate potential for:

- river discharge to groundwater (e.g. A, D, F, G, H, I)
- groundwater discharge to the river (e.g. B, C, E)

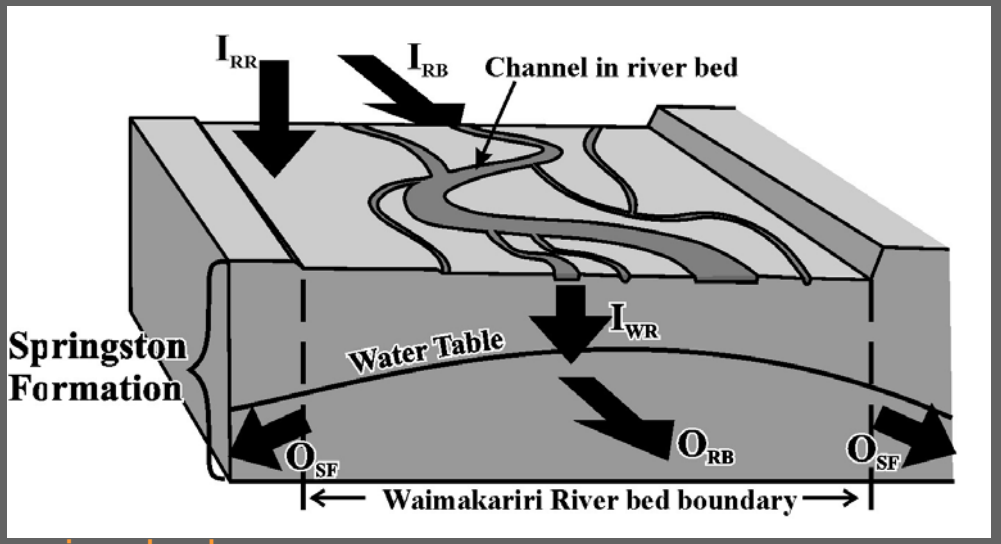


Waimakariri River bed groundwater budget in each reach

Groundwater budget equation:

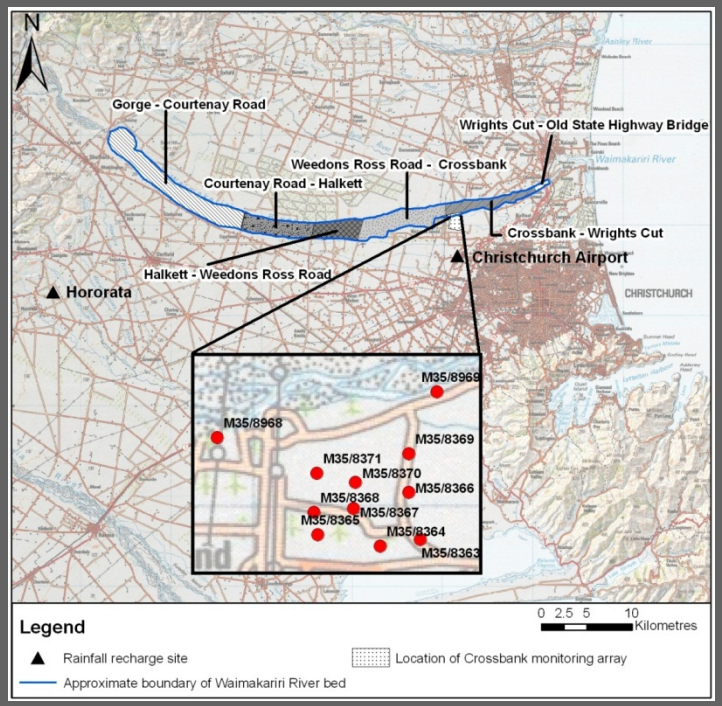
gw inflows = gw outflows

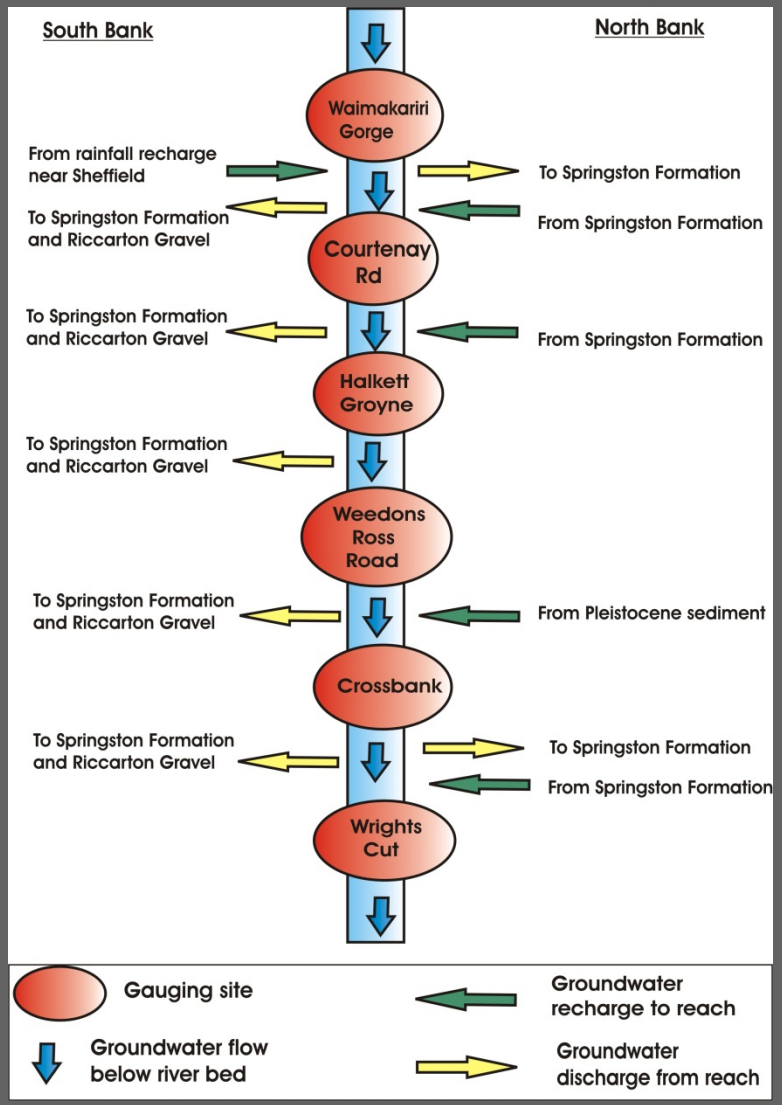
$$I_{RR} + I_{WR} + I_{RB} = O_{RB} + O_{SF}$$



I_{RR} inflow of rainfall recharge through the dry river bed;
I_{WR} inflow of river recharge from Waimakariri River channels;
I_{RB} groundwater inflow from the upstream reach in Springston Formation river bed gravels;
O_{RB} groundwater outflow to the downstream reach in Springston Formation river bed gravels;
O_{SF} groundwater outflow to Springston Formation gravels beside the river bed.

Surface and groundwater budgets in six reaches

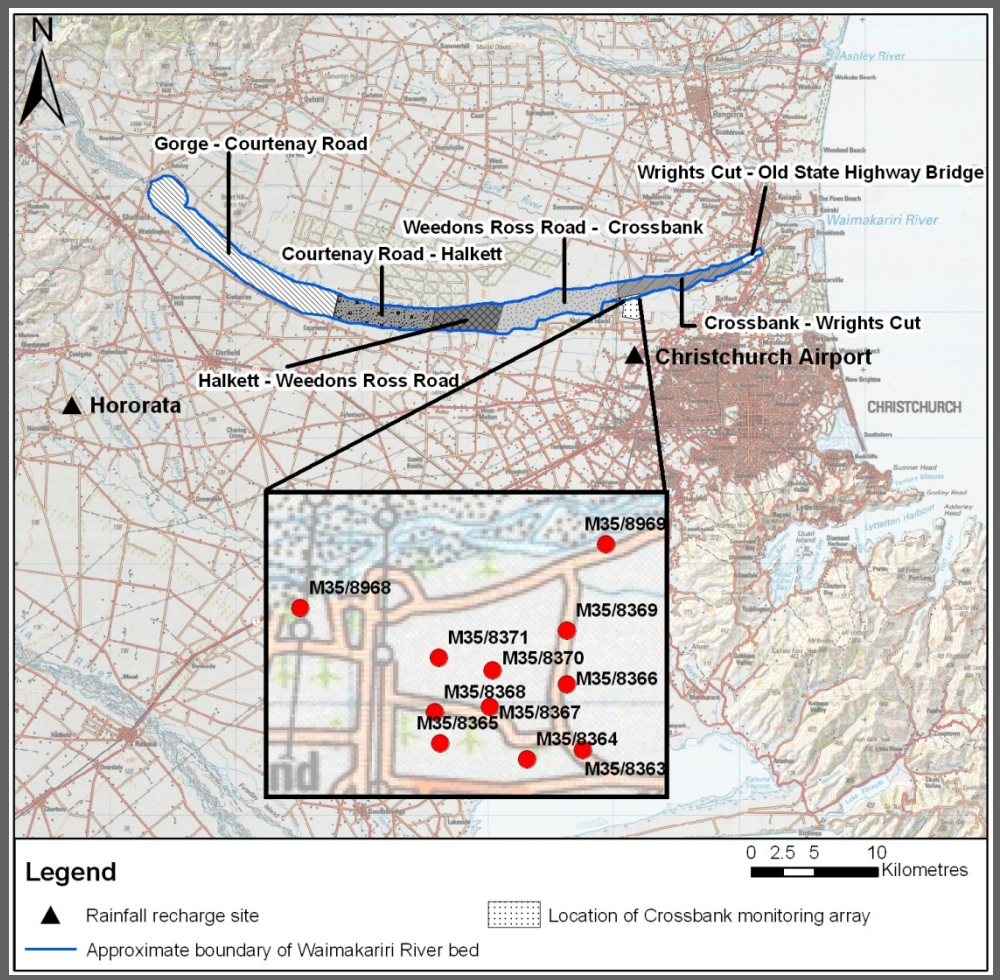




Waimakariri River reaches

Six reaches are identified

Location of Crossbank groundwater level monitoring array indicated



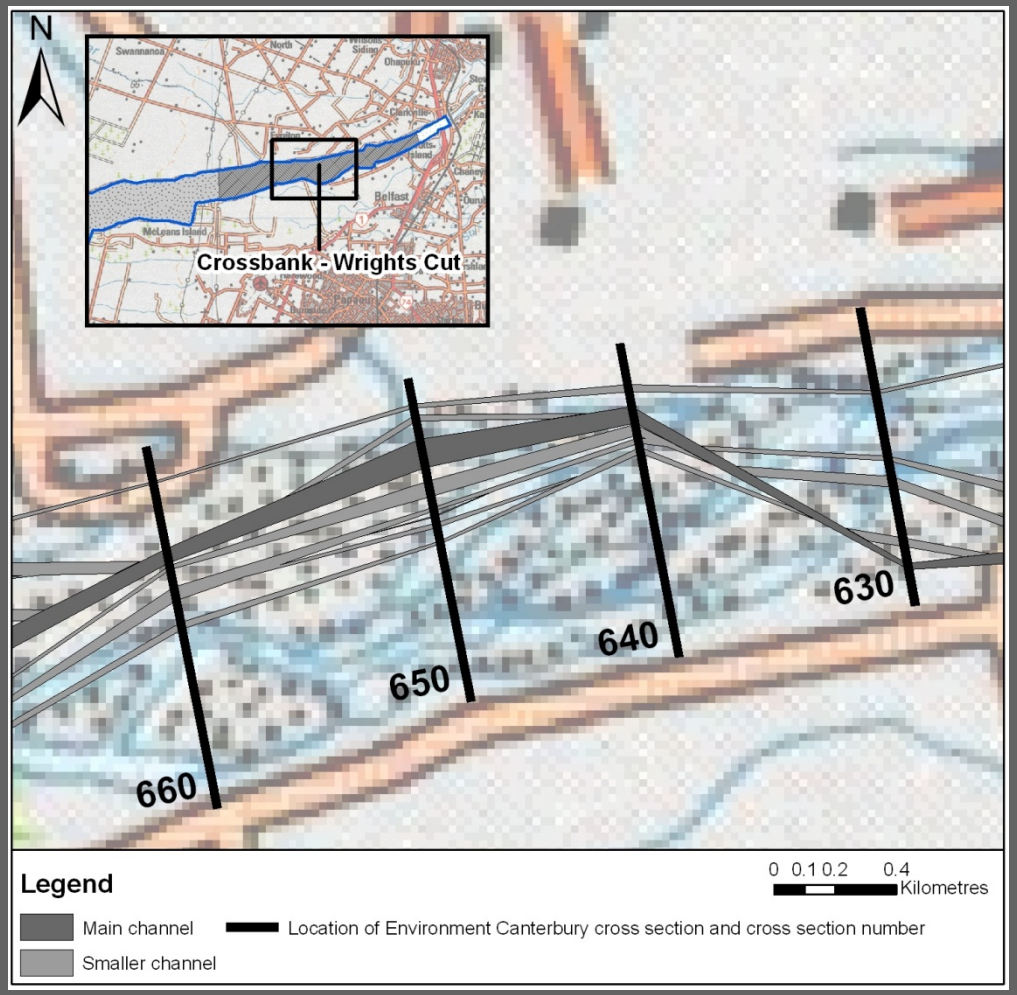
Steady-state groundwater model: river channel width

Method

- estimate dry river bed area at average flow; by

- calculating channel area for average flow and estimated river flow – channel width relation; using Environment Canterbury river cross observations at low flow

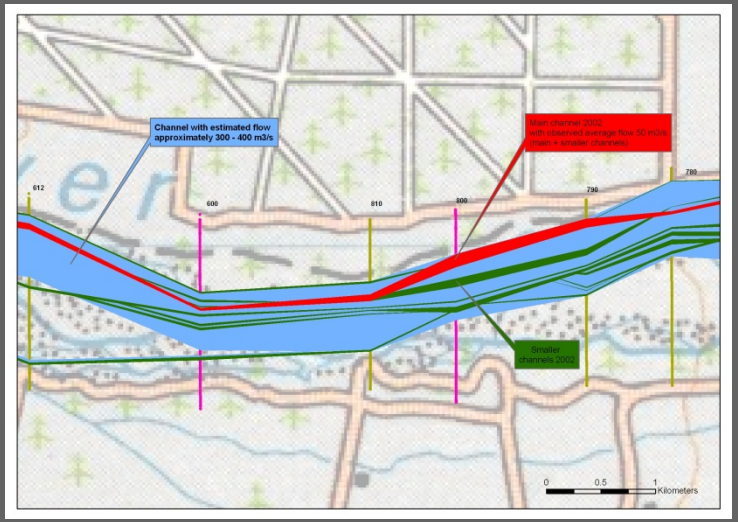
  e.g. $W = 54Q^{0.42}$



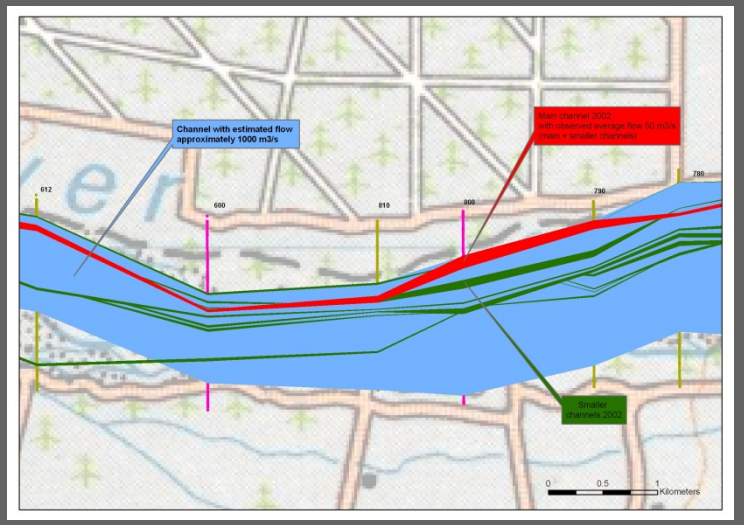
Waimakariri River bed and river flow

Estimated river bed area (blue)

300 – 400 m^3/s



1000 m^3/s



Steady-state surface water model: I_{wr} (river recharge to groundwater)

- Estimates river gains and losses between pairs of gaugings measured between 1953 and 2009

  - 88 are ‘concurrent’ gaugings i.e. measured in a two-day window

  - 14 gauging sites

  - flow less then 80 m^3/s is relatively stable over time

  - calculate flow differences between all pairs of gaugings (flow less than 80 m^3/s) at the tops and bottoms of reaches

Steady-state model surface water flows:

$R_O - R_I = I_{WR} + S + IS$

where:

$R_O - R_I$ = Waimakariri River flow gain or loss

I_{WR} = river gain from, or loss to, groundwater in the river bed calculated to balance the water budget

S = stream inflow

IS = irrigation, or stock water, outflow

Steady-state model: surface water flows
I_{wr} (river recharge to groundwater)

Waimakariri River reach	$R_O - R_I$ (m^3/s)	S (m^3/s)	IS (m^3/s)	I_{WR} (m^3/s)
Waimakariri Gorge-Courtenay Road	-4.5	0	-1.7	**-2.8**
Courtenay Road-Halkett	-2.5	0	-1.4	**-1.1**
Halkett-Weedons Ross Road	-3.1	0	-0.9	**-2.2**
Weedons Ross Road-Crossbank	-5.7	0	0	**-5.7**
Crossbank-Wrights Cut	0.1	0	0	**0.1**
Wrights Cut-Old State Highway Bridge	4	3.5	0	**0.5**
Total	-11.7	3.5	-4	**-11.2**

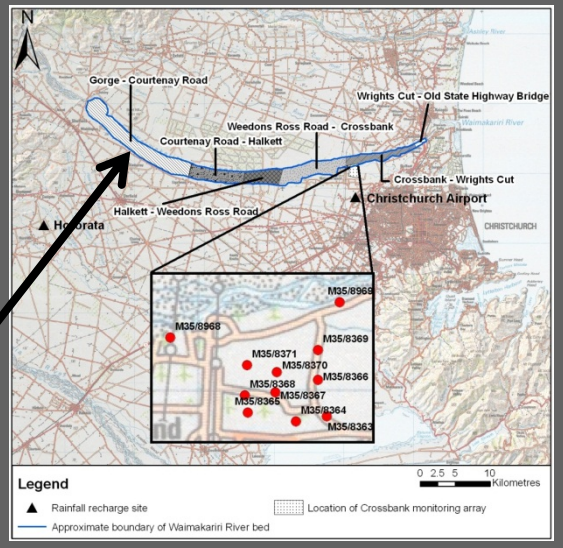
Steady-state groundwater flows: groundwater budget

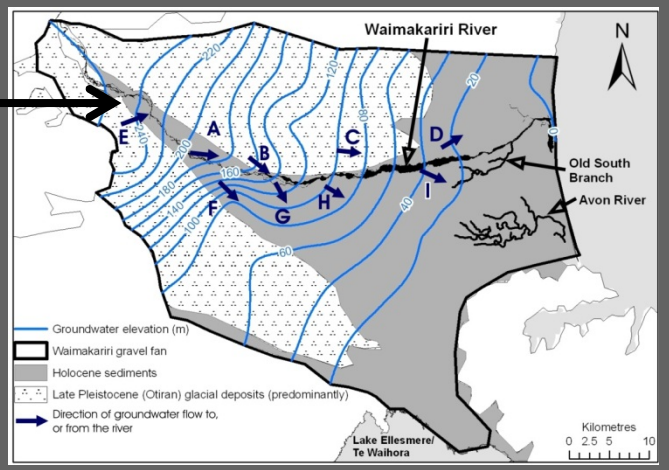
Waimakariri River reach	I_{RR} (m^3/s)	I_{WR} (m^3/s)	I_{RB} (m^3/s)	O_{RB} (m^3/s)	O_{SF} (m^3/s)
Waimakariri Gorge-Courtenay Road	0.3	2.8	0.1	-4.4	1.2
Courtenay Road-Halkett	0.1	1.1	4.4	-4.4	-1.2
Halkett-Weedons Ross Road	0.1	2.2	4.4	-4.2	-2.5
Weedons Ross Road-Crossbank	0.1	5.7	4.2	-4.5	-5.5
Crossbank-Wrights Cut	0.1	-0.1	4.5	-1.7	-2.8
Wrights Cut-Old State Highway Bridge	0	-0.5	1.7	-0.3	-0.9
Total	0.7	11.2	19.3	-19.5	-11.7

Steady-state groundwater budget: implications

Five reaches lose to groundwater
- consistent with gw level measurements

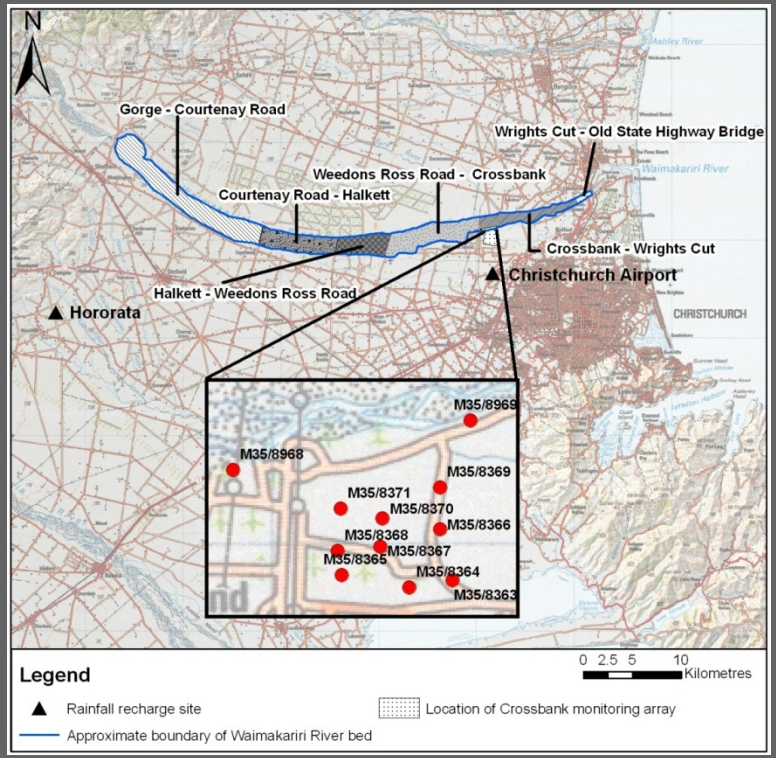
One reach gains groundwater
- also consistent with gw level measurements



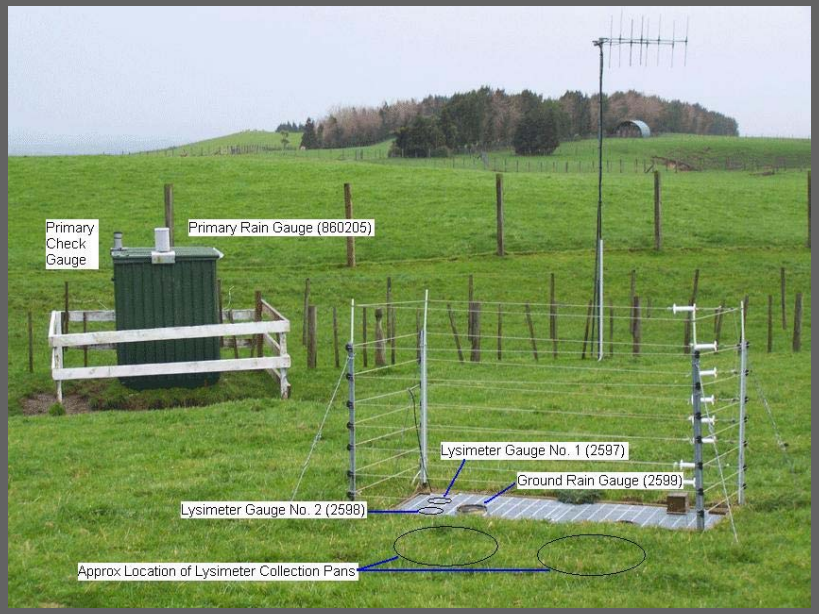


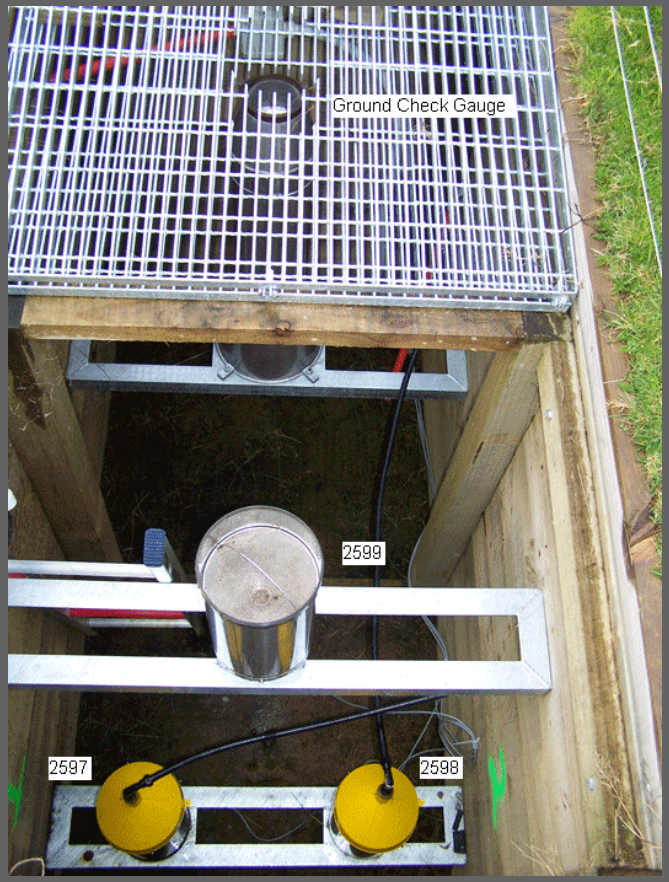
Transient model

- Estimates inflows and outflows at a daily time step in the period 1st July 2002 to 30th June 2008
- Aims to identify river recharge as separate from rainfall recharge



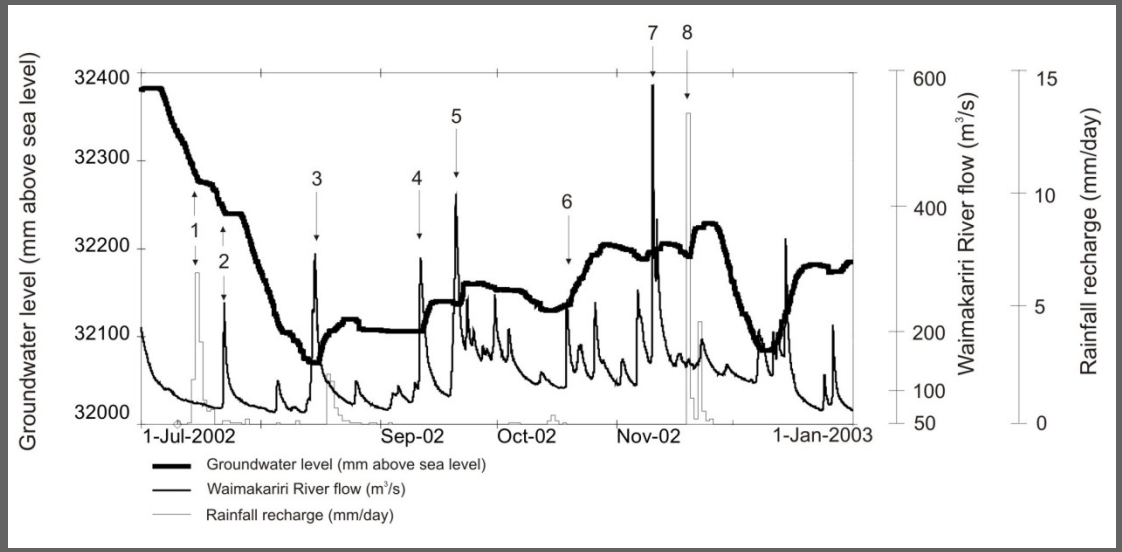
Transient model: rainfall recharge site





Transient model: example of groundwater level response to river and rainfall events at Crossbank monitoring array

Events:
1, 8: rainfall recharge only
2, 3, 4, 5, 6, 7: river recharge only



Transient model: example of groundwater level response to river and rainfall events at Crossbank monitoring array

$O_{SFC} + RR_{TGBA} - D_{TGBA} = \Delta V_{TGBA}$

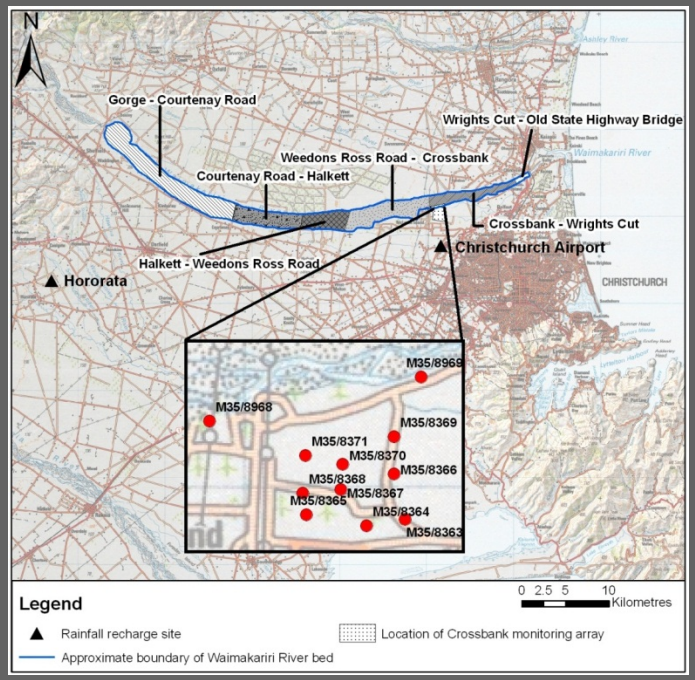
where

O_{SFC} = daily inflow from the river bed calculated to balance the water budget

RR_{TGBA} = daily inflow from rainfall recharge

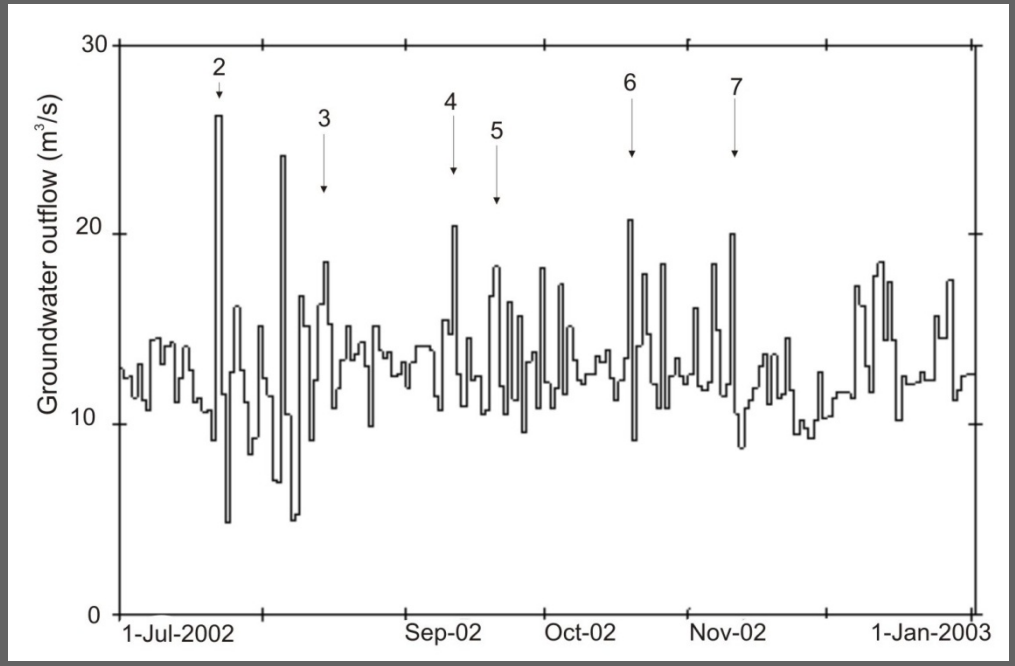
D_{TGBA} = daily outflow

ΔV_{TGBA} = daily change of groundwater volume



Transient model: groundwater outflow from losing reaches

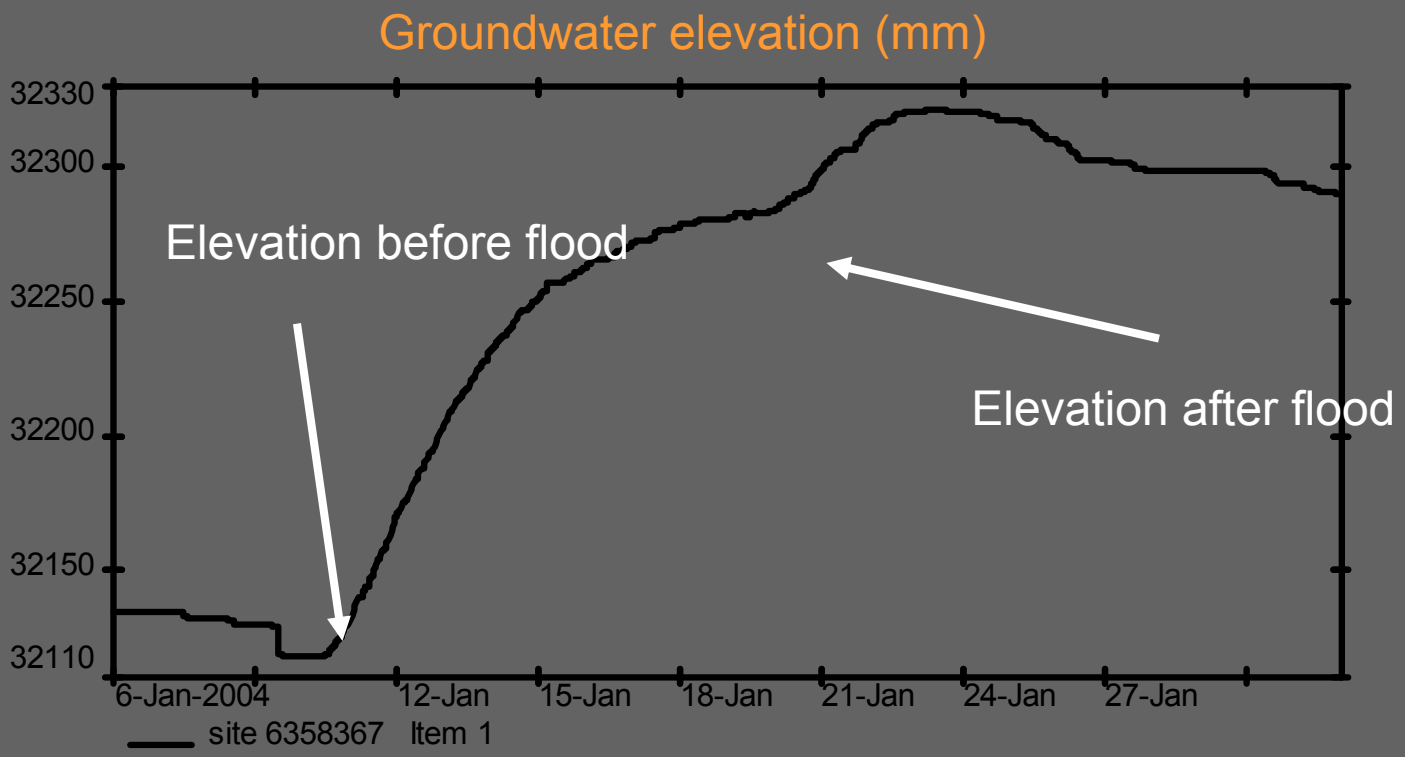
- Groundwater outflow up to about 25 m^3/s in 2002
- Peaks related to river flow events
- However gw outflow at times of high river flow is a small proportion of total outflow

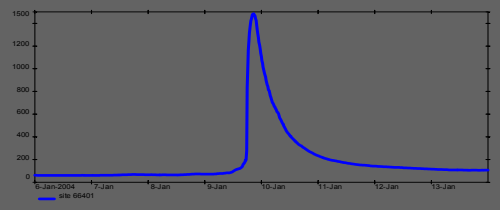


Transient model: groundwater outflow from losing reaches

Daily groundwater outflow (m^3/s)	Daily Waimakariri River flow (m^3/s)				
	27 - 60	60 - 120	120 - 180	180- 240	Greater than 240
Mean	**12.4**	**12.5**	**13.2**	**14.2**	**17.0**
Median	12.4	12.5	12.6	13.8	15.8
Standard deviation	0.7	1.7	2.5	3.4	5.7

Groundwater level response to flood

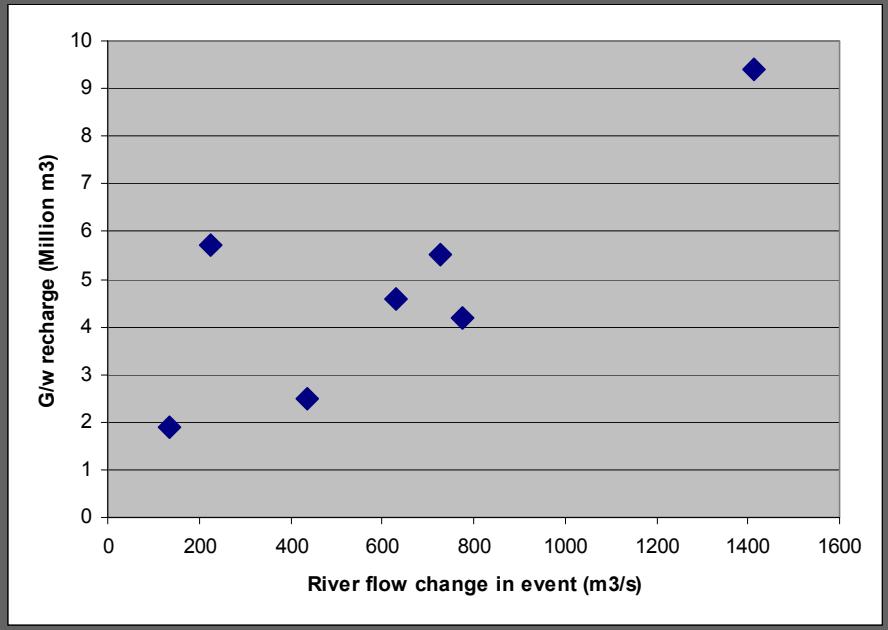




River flow (max. approx. 1500 m^3/s)

Flow events and groundwater recharge (period 1999-2005) - establish calibration

River flow change (m^3/s)	G/w recharge in 30 km of river bed (Million m^3)
728	5.5
1412	9.4
776	4.2
437	2.5
224	5.7
631	4.6
135	1.9



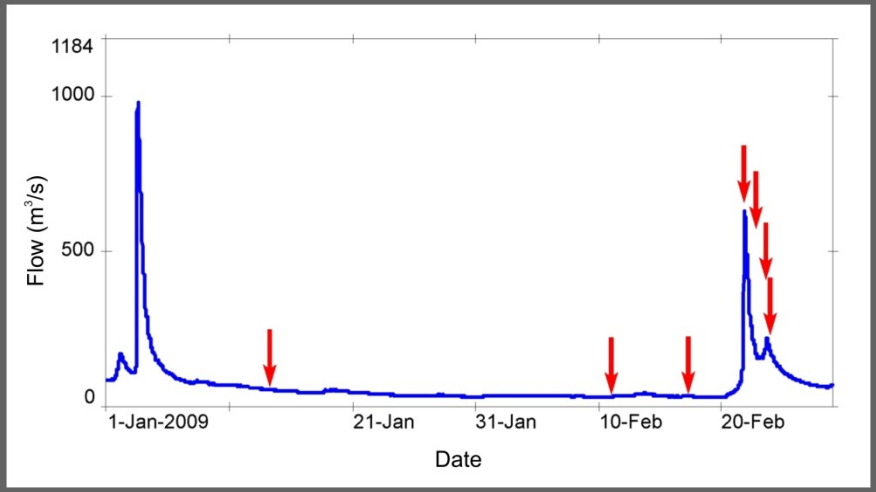
Flow events and groundwater recharge (period 1999-2001) - apply calibration

- 93 events of Waimakariri River flow;
- Waimakariri River flow increase in range 3.3 m^3/s to 1140 m^3/s;
- est. groundwater recharge volume with these events 81.9 Million m^3
- average groundwater recharge approx 0.9 m^3/s;
  0.9 m^3/s in 1999
  1.4 m^3/s in 2000
  0.3 m^3/s in 2001.
- therefore average groundwater recharge associated with flood events is quite small compared with nett average outflow (11.7 m^3/s average)

Nutrient inflows to groundwater

Waimakariri River sampling on an event basis (red arrows)

River flow →

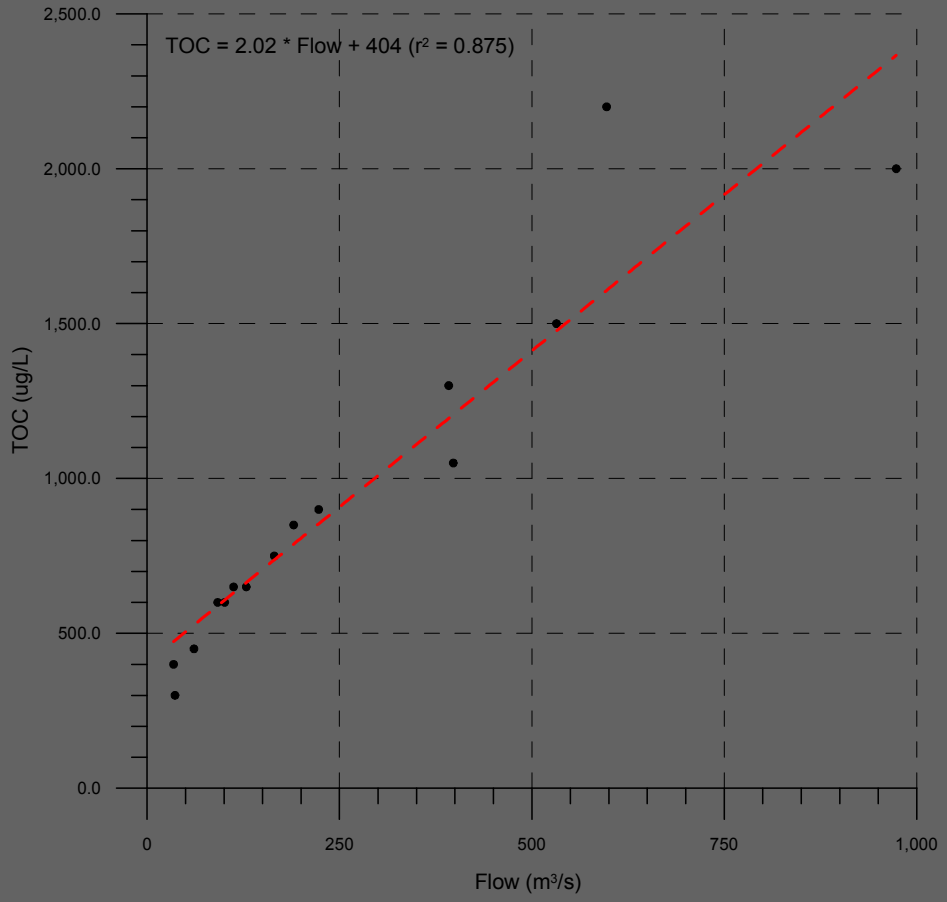


Carbon and nutrient inflows to groundwater

- a reasonably strong correlation between TOC and flow (r^2 = 0.875)

- somewhat less strong correlations for
  DRP (r^2 = 0.51),
  ammonia-nitrogen (r^2 = 0.68),
  total nitrogen (r^2 = 0.68)

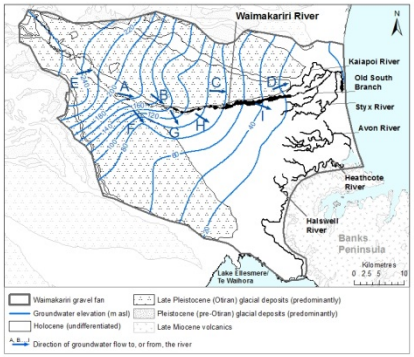
- no correlation at all was evident between nitrate-nitrogen and flow (r^2 = 0.0003).



Nutrient in groundwater outflow

Item	Item	TOC	DRP	NH_3-N	NO_3-N	TN
Waimakariri River	Mean (µg/L)	572	2	1	75	99
	Maximum (µg/L)	3113	12	8	75	651
	Standard deviation (µg/L)	180	1	1	0	39
Groundwater in Crossbank wells	Mean (µg/L)	442	1	2	87	111
	Maximum (µg/L)	500	2	3	113	149
	Standard deviation (µg/L)	51	0.5	1	17	21

Nutrient in groundwater outflow



NO3-N concentrations

- Old South Branch: 200 – 500 µg/L
- Avon: 1000 µg/L
- Halswell: 3300 µg/L

NO3-N increases away from the river due to influence of land use, e.g. at Airport monitoring site

- NO3-N in rainfall typically less than 30 µg/L.
- NO3-N in rainfall recharge average 1300 µg/L

Waimakariri River allocation policy

"AA" permits which are principally for community supplies and stock water; and "A" and "B" permits for other uses, including irrigation. Allocation limits, in summary, include:

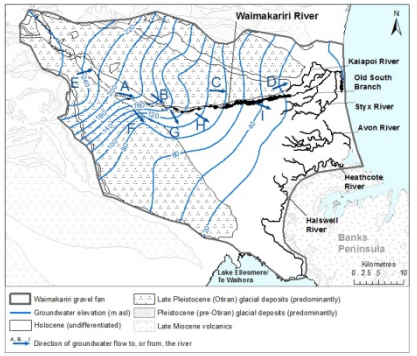
- 5 m^3/s for "AA" permits;
- 17 m^3/s above a river flow of 46 m^3/s for "A" permits;
- 27 m^3/s above a river flow of 68 m^3/s, with 1:1 flow sharing, for "B" permits. Flow sharing means that not more than half the flow above 68 m^3/s may be used.

Groundwater outflow with Waimakariri River allocation policy (CRC)

Item	Observed Waimakariri River flow	Estimated Waimakariri River flow, full use of allocation
Daily Waimakariri River flow (m^3/s)	101.1	76.4
Number of days daily river flow < 60 m^3/s	704	1310
Daily groundwater outflow (m^3/s)	12.9	12.7
Groundwater outflow, standard deviation (m^3/s)	1.0	0.9

Groundwater outflow and flow in spring-fed streams

Aim to estimate the catchments of spring-fed streams



Groundwater outflow and flow in spring-fed streams

Reaches between Courtenay Road and Weedons Ross Rd (groundwater outflow 3.7 m^3/s) provide most of the baseflow in the Halswell, Heathcote and Avon rivers (surface water baseflow 3.6 m^3/s);

Reaches between Weedons Ross Rd and Wrights Cut (groundwater outflow 8.3 m^3/s) provide baseflow (7.3 m^3/s) to the Old South Branch, Styx River and streams north of the Waimakariri River.

That’s it!!!

Thanks very much!