Project 3.2 Catchment-scale retrofit:

experimental assessment of the ability of new multi-scale urban stormwater management approaches to protect the hydrology, water quality and ecology of receiving water ecosystems.

At UoM: *Chris Walsh Tim Fletcher, Darren Bos, Samantha Imberger, Genevieve Hehir, Matt Burns, Michael Sammonds, Peter Poelsma, Geoff Vietz, Jeremie Bonneau, Kathryn Russell, Congying Li, Julia White, Andrew Thomas;*
At MW: *Rachelle Adamowicz, Marion Urrutiaguer, Michael Godfrey, Peter Morison, Rhys Coleman;*
At YRC: *Beth Wallis, Stephanie Hamel*
At DELWP: *Ann Allworth;*
At Knox: *Matt Potter*

LP0883610
LP130100295

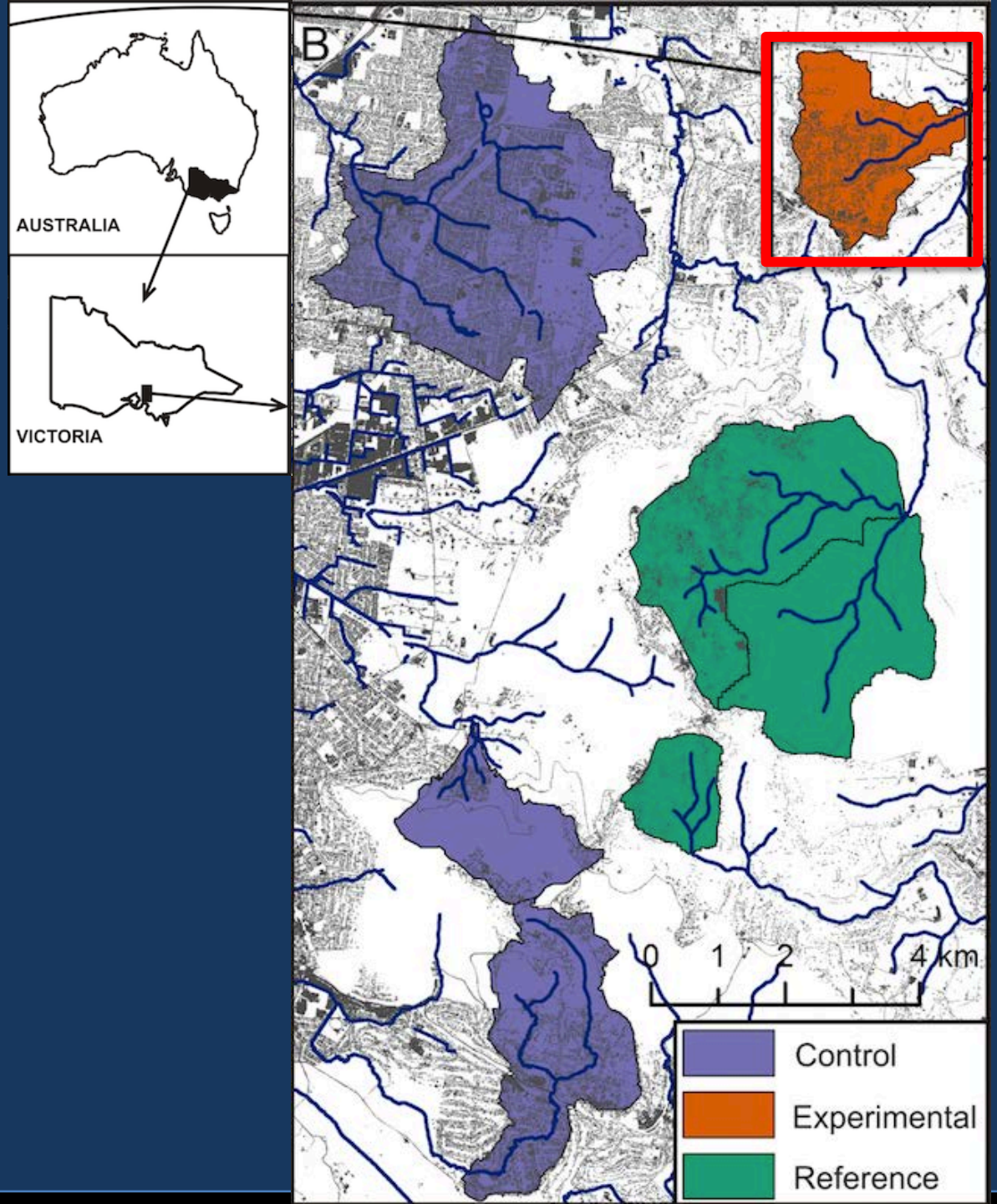
Urban stormwater runoff degrades streams

Current dominant approaches to managing stormwater runoff for environmental protection do not protect stream ecosystems

We hypothesise that stream restoration is possible using stormwater control measures in the catchment
designed to:

1. Reduce size and frequency of untreated runoff
2. Restore quality and pattern of filtered flows to match pre-development stream flow regime
3. Reduce runoff volume to match pre-development volume

Can new stormwater management at a catchment-scale restore degraded urban streams?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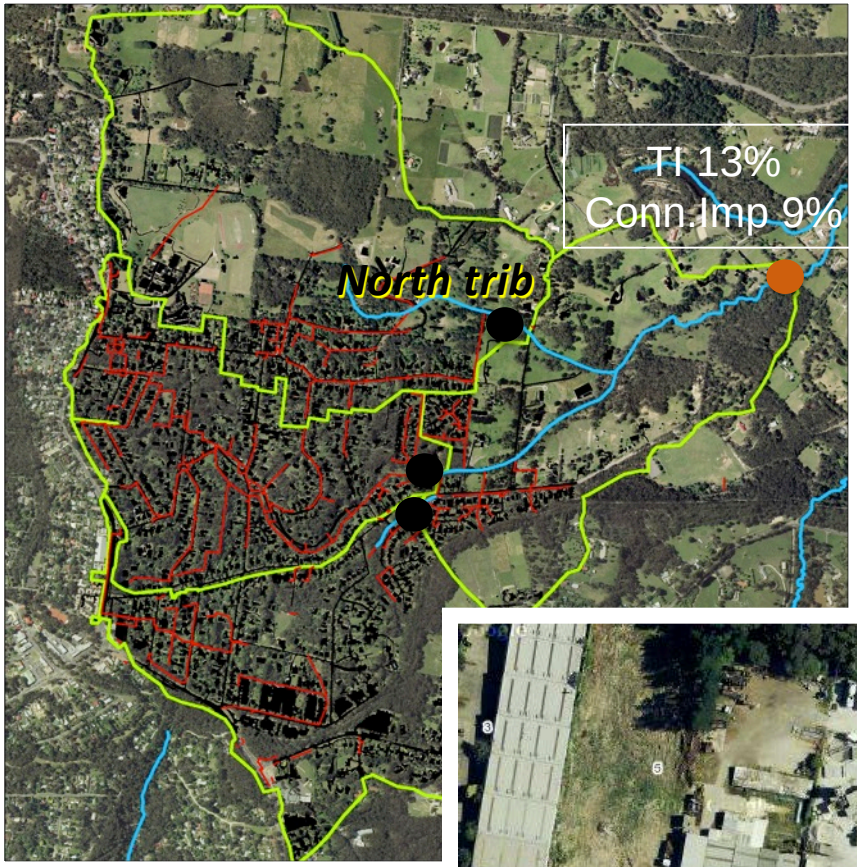
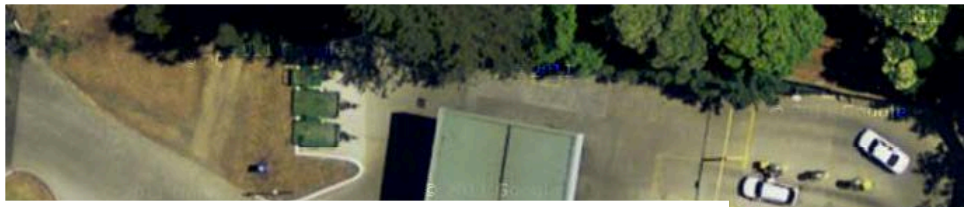
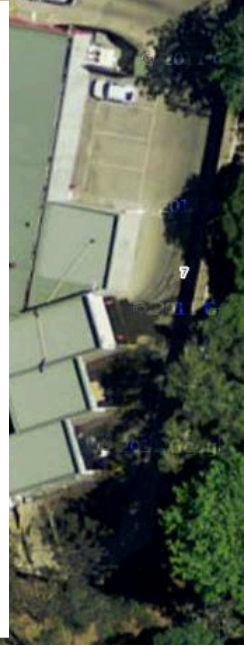
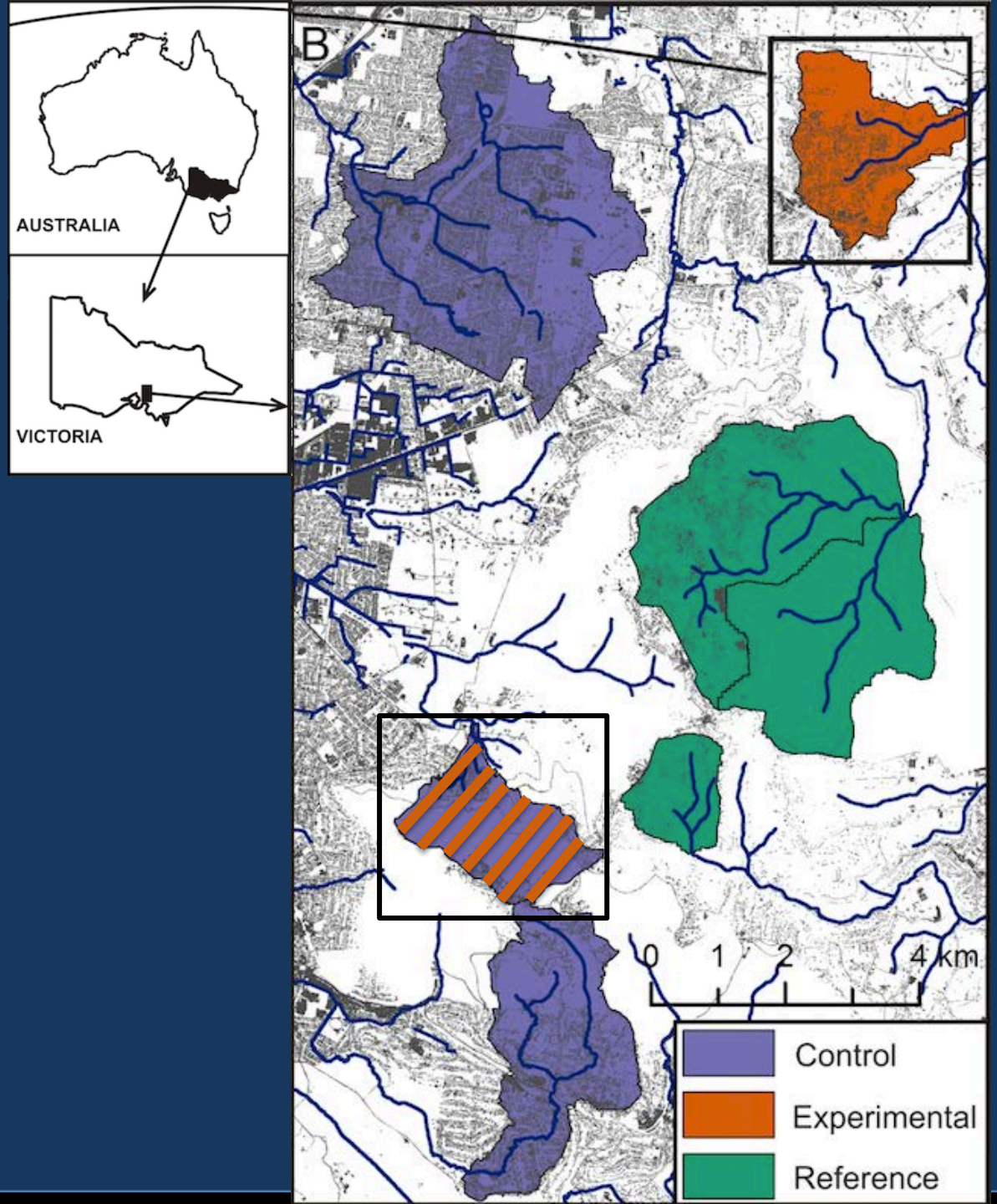
Little Stringybark Creek catchment





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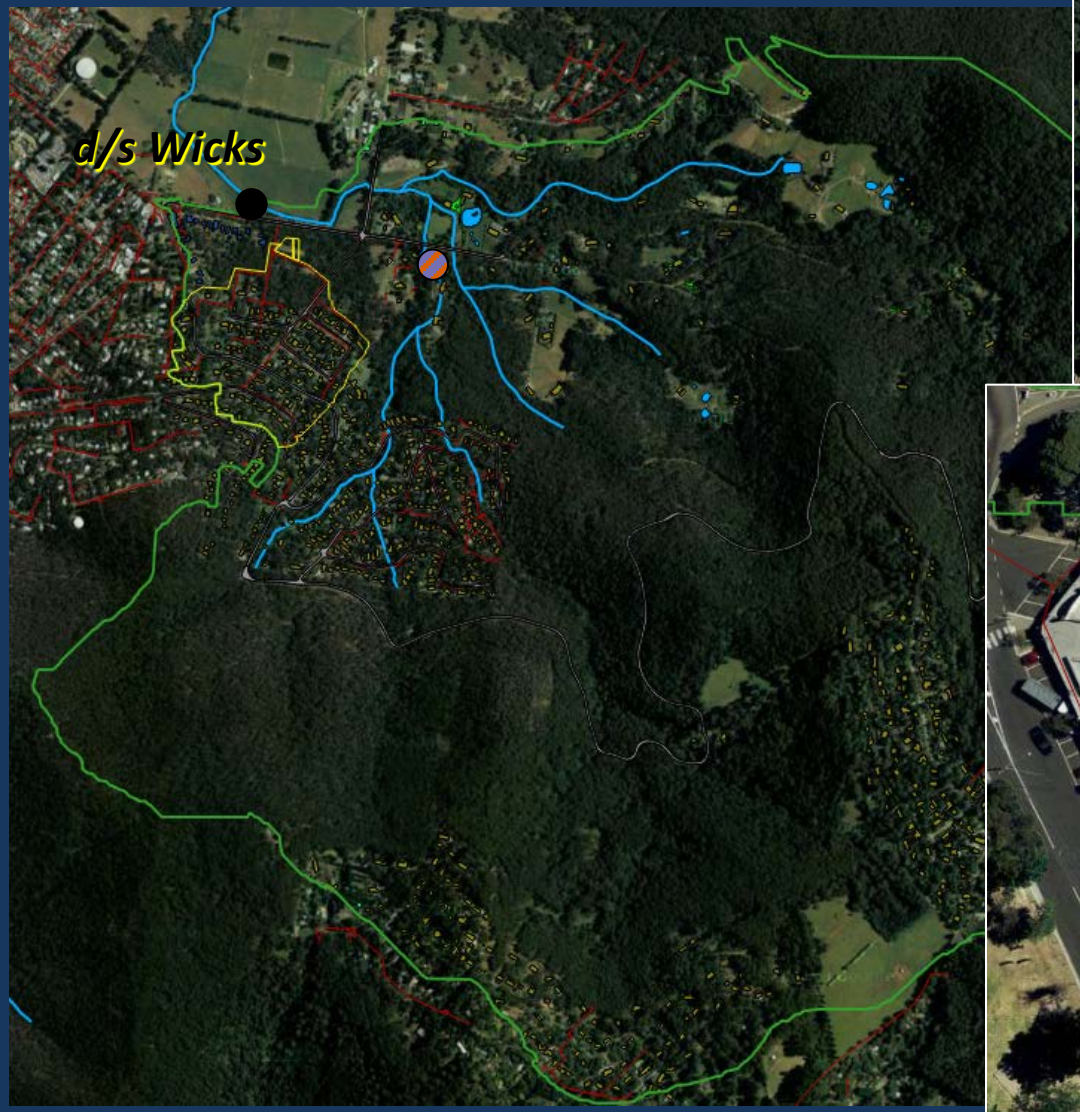
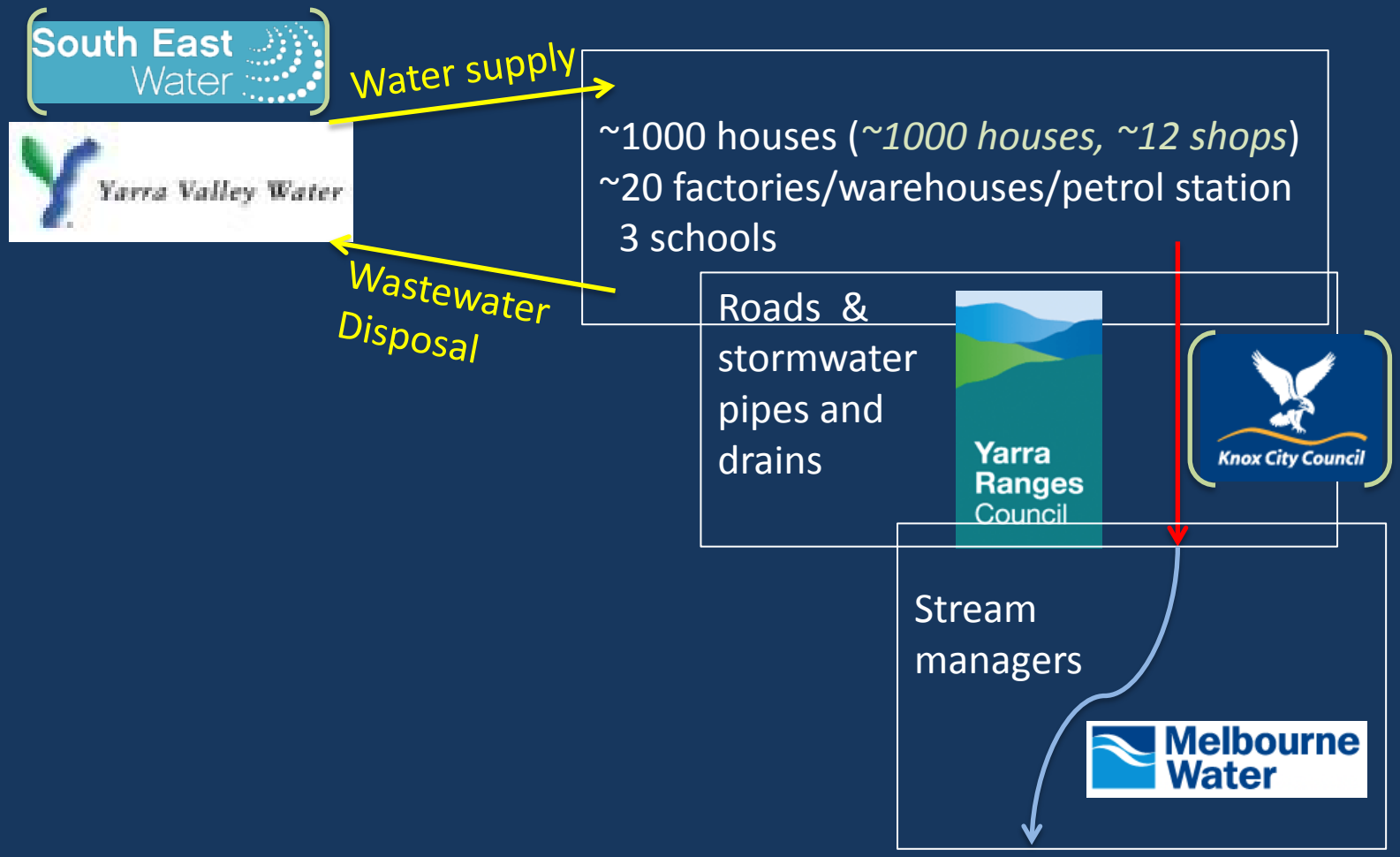
Dobsons Creek catchment



The LSC (*and Dobsons*) communities

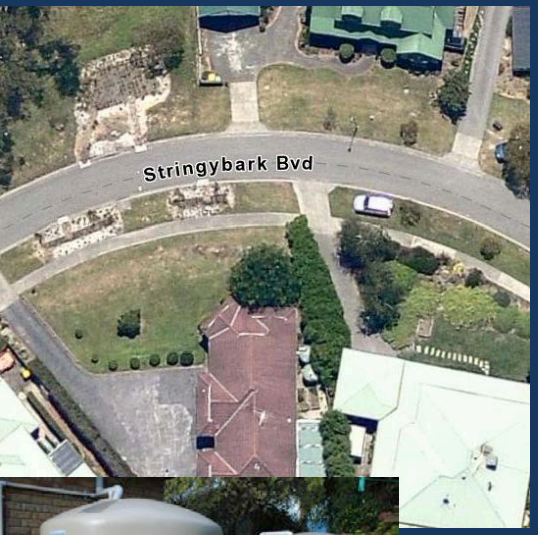


LSC: ~300 Stormwater retention systems constructed by the end of 2013

(more to come in 2016, similar number in Dobsons)

Impervious area treated

100-1,000 m^2



1,000-5,000 m^2

10,000-20,000 m^2

A special series in Freshwater Science (September 2015: open source)

BRIDGES*

Stream experiments at the catchment scale: the challenges and rewards of collaborating with community and government to push policy boundaries

Christopher J. Walsh[1,2] and Tim D. Fletcher[1,3]

[1]School of Ecosystem and Forest Sciences, University of Melbourne, 500 Yarra Boulevard, Burnley, Victoria 3121 Australia

BRIDGES*

Restoring a stream through retention of urban stormwater runoff: a catchment-scale experiment in a social–ecological system

Christopher J. Walsh[1,2], Tim D. Fletcher[1,3], Darren G. Bos[1,4], and Samantha J. Imberger[1,5]

[1]School of Ecosystem and Forest Sciences, University of Melbourne, 500 Yarra Boulevard, Burnley, Victoria 3121 Australia

Abstract: Restoration of ecological structure and function of urban streams probably requires catchment-scale
fication of drainage infrastructure, but such catchment-scale restoration attempts and their assessment are

BRIDGES*

Overcoming barriers to community participation in a catchment-scale experiment: building trust and changing behavior

Darren G. Bos[1,3] and Helen L. Brown[1,2,4]

[1]School of Ecosystem and Forest Sciences, University of Melbourne, 500 Yarra Boulevard, Burnley 3121 Australia
[2]Department of Geography, University of Sheffield, Sheffield S10 2TN UK

Abstract: Communities have an important role to play in the protection of urban streams, parti
stormwater runoff from their properties is managed. As part of a larger research project, we u
approaches to engage communities in protecting their local creek by managing their properties'
off. We assessed their success through surveys and measurements of uptake. Our initial effor
interest from the community, but participation rates were greatest when the application proce
and barriers to participation were removed. The sequential implementation of the approaches li
their comparative effectiveness, but the results suggest that the iterative and adaptive nature and
of the process facilitated the targeting of diverse motivations and the building of community tru
led to greater community participation.

BRIDGES*

Building capacity in low-impact drainage management through research collaboration

Matthew J. Burns[1,2], Elizabeth Wallis[1,3], and Vjekoslav Matic[1,4]

[1]Yarra Ranges Council, 15 Anderson Street, Lilydale 3140 Australia

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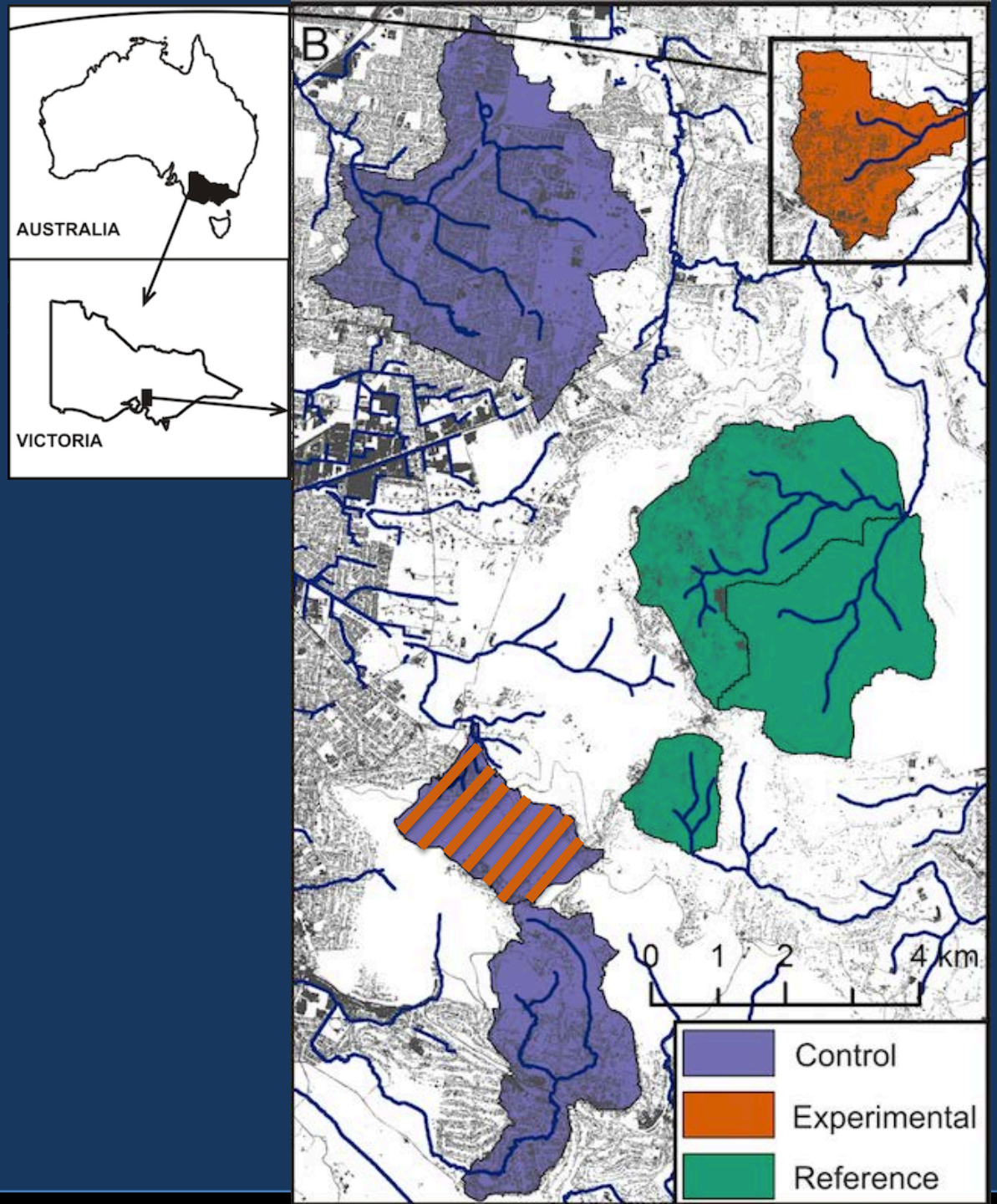
BRIDGES*

Integrating stormwater management to restore a stream: perspectives from a waterway management authority

Toby Prosser[1,4], Peter J. Morison[1,2,5], and Rhys A. Coleman[1,3,6]

[1]Melbourne Water, 990 Latrobe Street, Melbourne 3000 Australia
[2]School of Ecosystem and Forest Sciences, University of Melbourne, 500 Yarra Boulevard, Burnley 3121 Australia
[3]School of Biosciences, University of Melbourne, Parkville 3010 Australia

Abstract: Urban stormwater management is complex with diverse institutional responsibilities, imperfect regulation, and limited, often unclear accountabilities. Improving practices in that context requires strong leadership, long-term commitment, and lasting interorganizational relationships founded on trust. We summarize events that steered Melbourne's waterway management authority to support a catchment-scale experiment markedly different from management applications or research approaches it had previously attempted. We highlight challenges, lessons learned, and subsequent institutional changes to stormwater management. Project challenges included: substantial investment in a small area from an organization with dispersed regional responsibilities, gaining intra- and interorganizational commitment, ongoing catchment development that counteracted management efforts, requirement for ongoing investment under short-term funding and political cycles, and absence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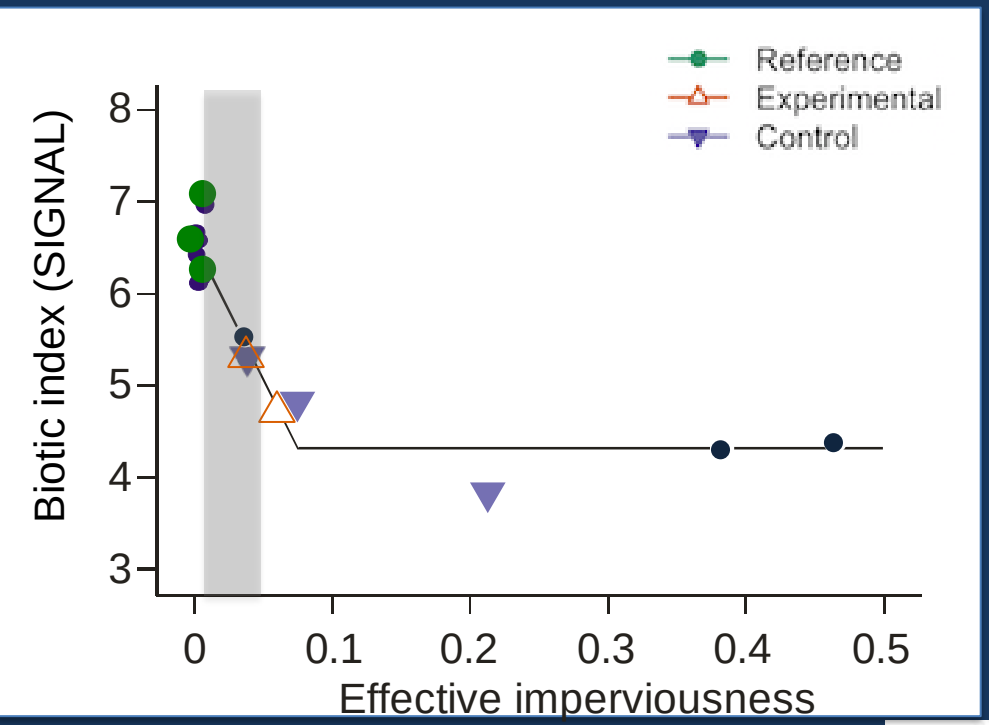
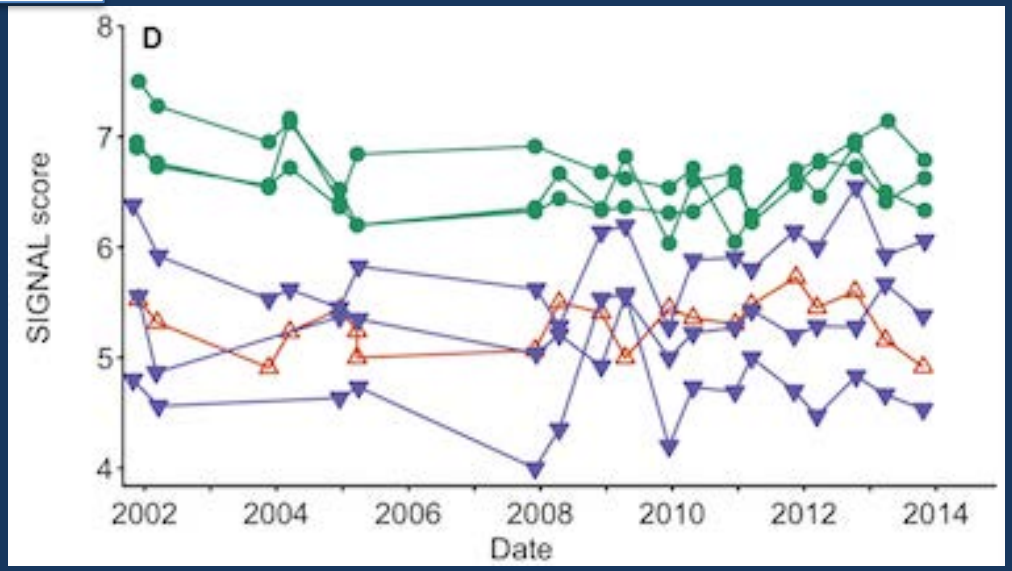
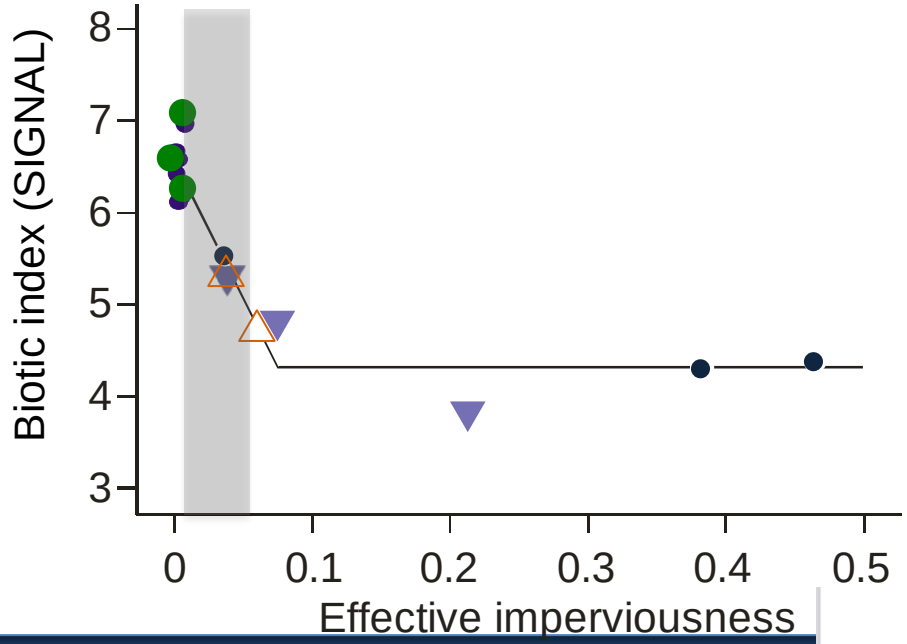
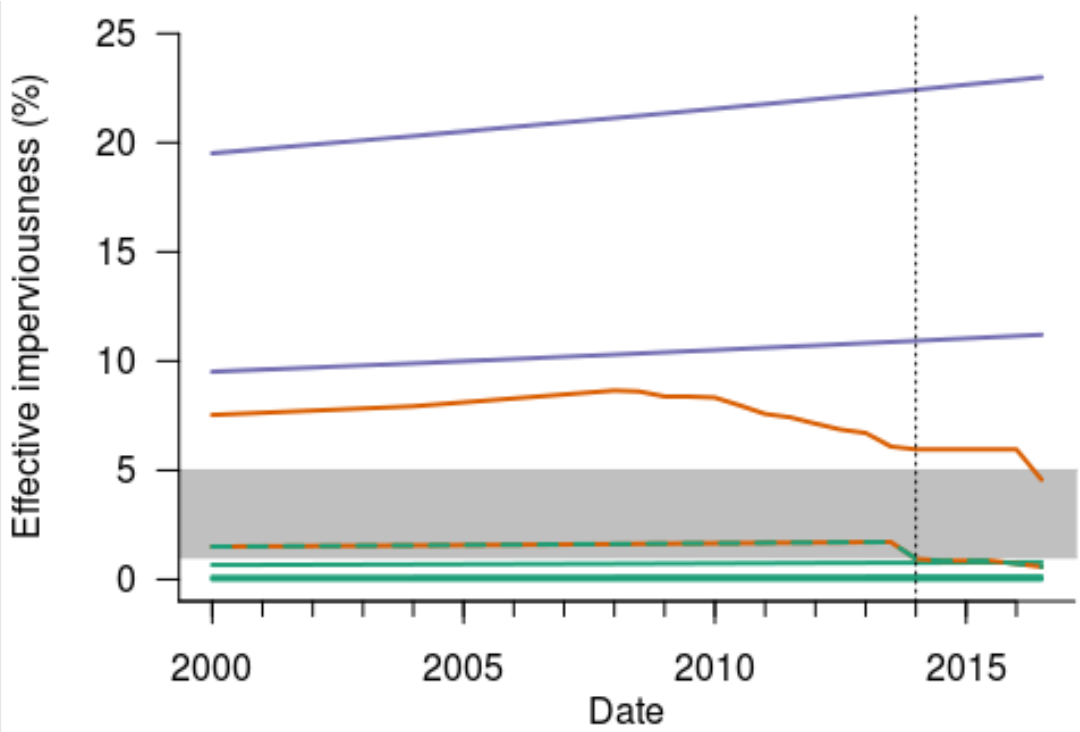
The primary hypothesis





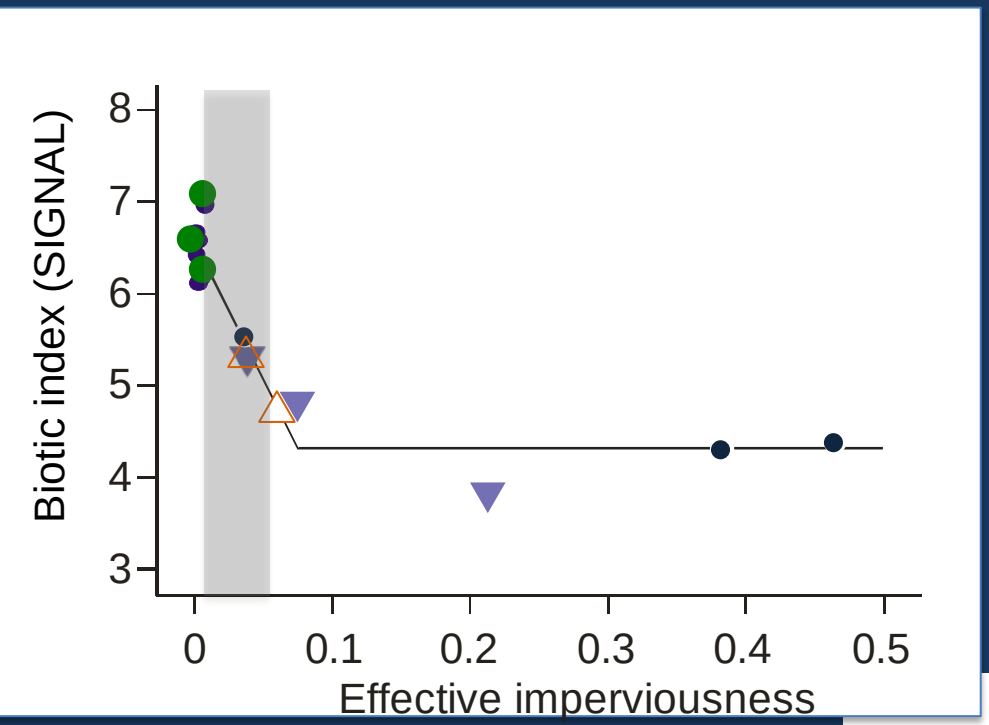
The experimental manipulation

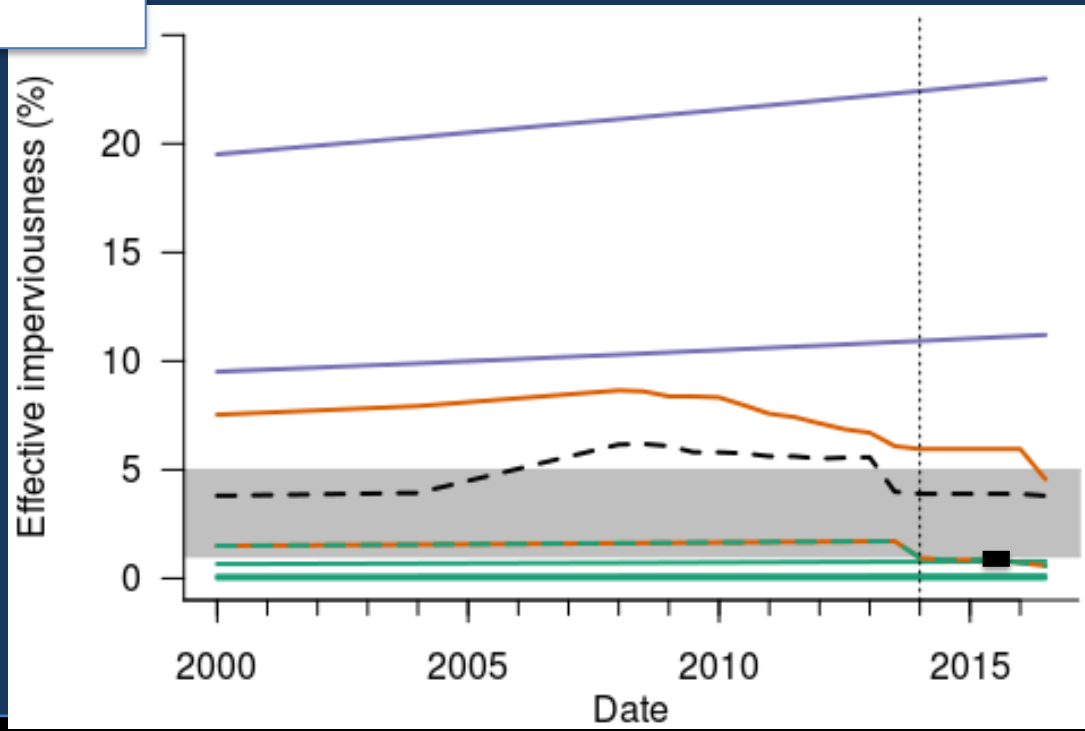


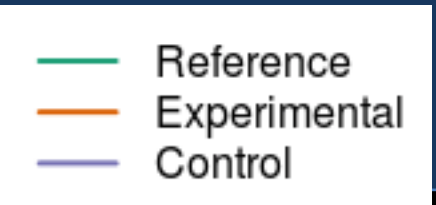


Reference
Experimental
Control

The experimental manipulation







Planning regulation to protect investment in stormwater control (and to protect streams)

Yarra Ranges Council

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- Events
- Current consultation
- Policy directory
- A-Z Listing
- Capital works & major projects
- Minutes & Agendas
- Find a preschool
- Family Day Care Educator directory
- Maternal & Child Health Centres

Amendment C122 - Little Stringybark Creek

Amendment C122 was approved by the Minister for Planning on 12 September 2013.

The Amendment introduced an Environmental Significance Overlay to the Little Stringybark Creek catchment area (Mt Evelyn) and will require new development creating additional hard surface area to treat storm water runoff.

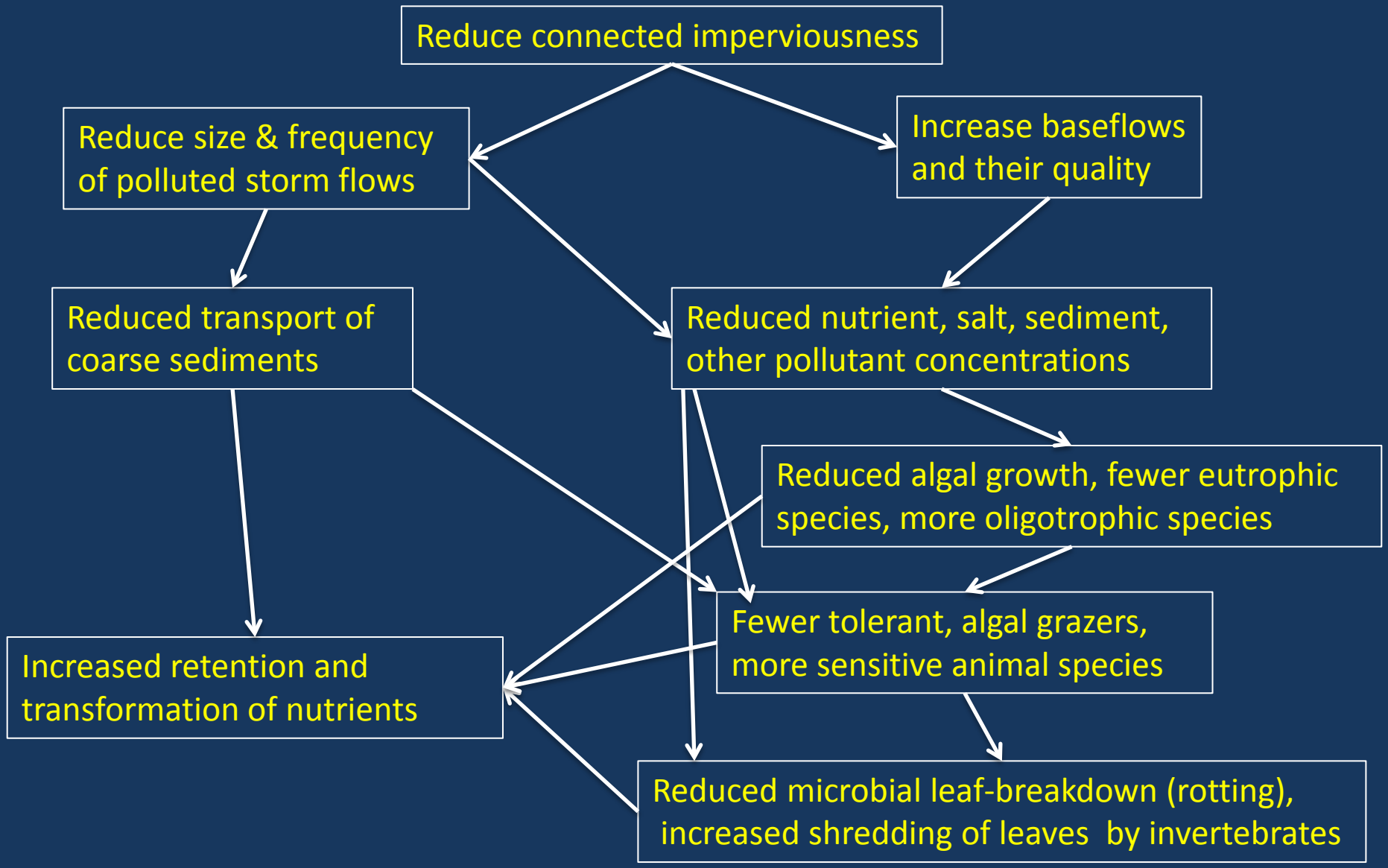
This can be achieved through a variety of methods including rain gardens, water tanks etc. *Note: the proposed planning control will not require residents to retrofit existing development.* The Environmental Significance Overlay will be in effect until 12 March 2018.

Further information about the project can be found in the Protecting Little Stringybark Creek - Brochure (PDF, 764KB) and fact sheet (PDF, 445KB).

If you are contemplating any development within the catchment area, please contact Council's planning services on 9294 6222 for information to assist with Melbourne Water's requirements and your planning permit application.

If you wish, you can complete your application to Melbourne Water by using the

Hypothesized mechanisms & responses

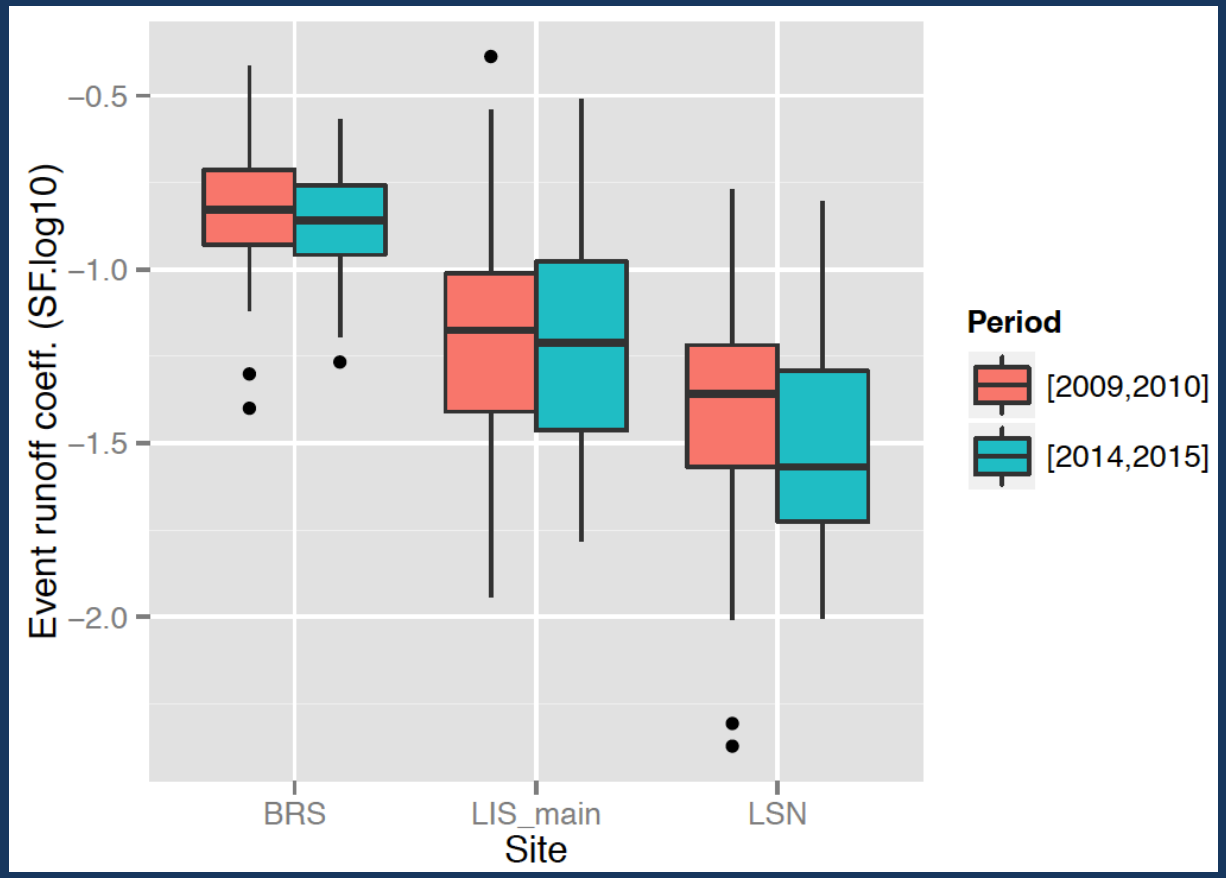


Hypothesized mechanisms & responses

Reduce connected imperviousness

Reduce size & frequency of polluted storm flows

Increase baseflows and their quality

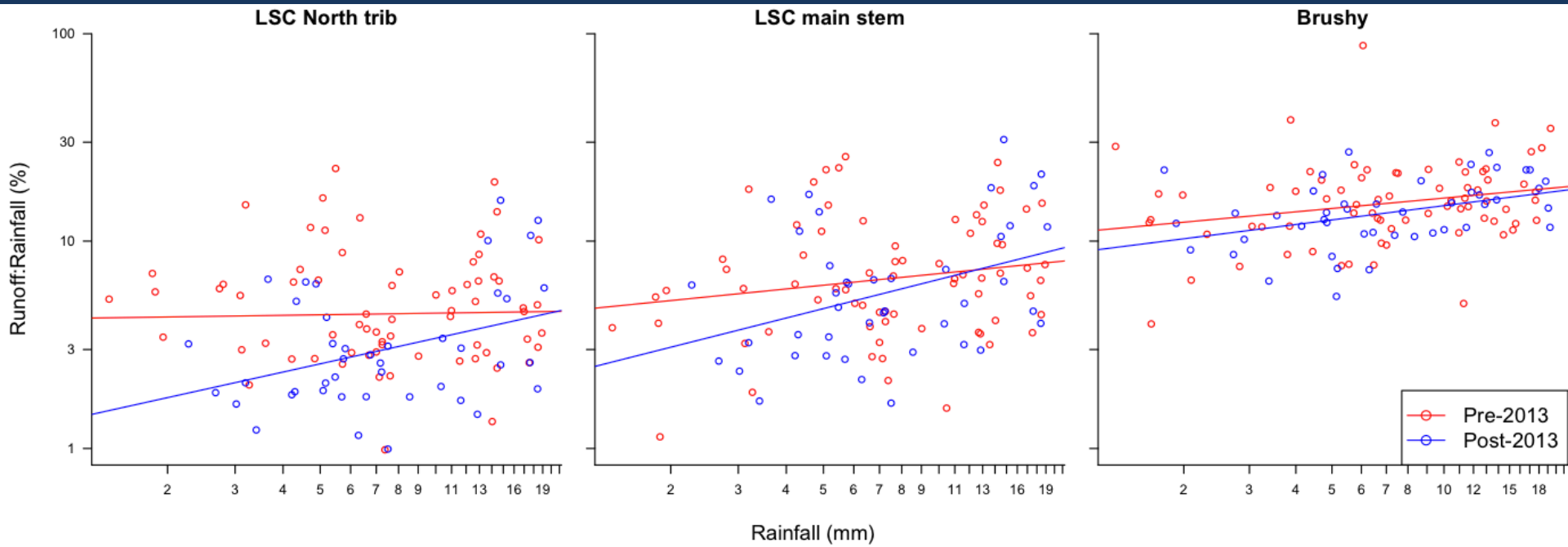


Congying Li

Vincent Schmitt

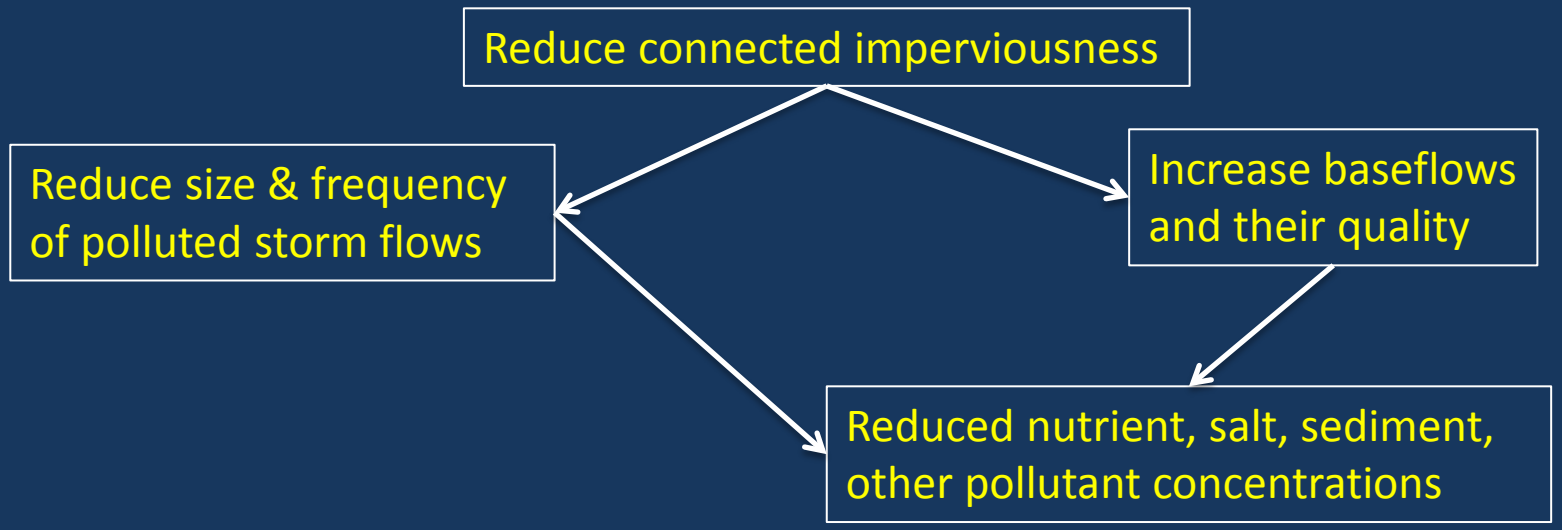
Matthiew Bachaud

Reduced size and frequency of polluted storm flows



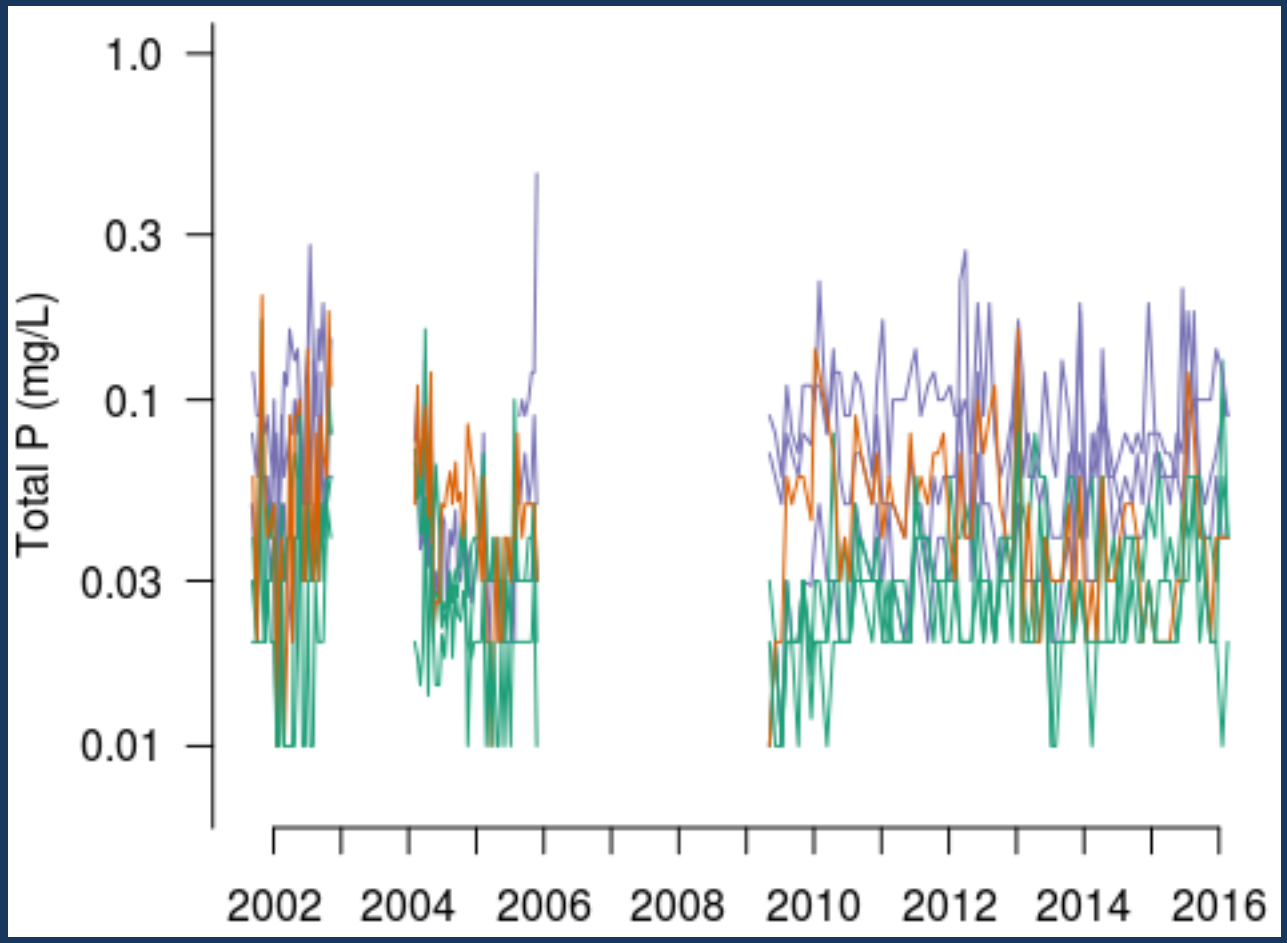
A big reduction in runoff from small, frequent events –
Bigger effect in Northern trib than in main stem
Effect not evident in Brushy, the control stream

Hypothesized mechanisms & responses



Nutrient, sediment, concentrations have declined in LSC

yeah, right….



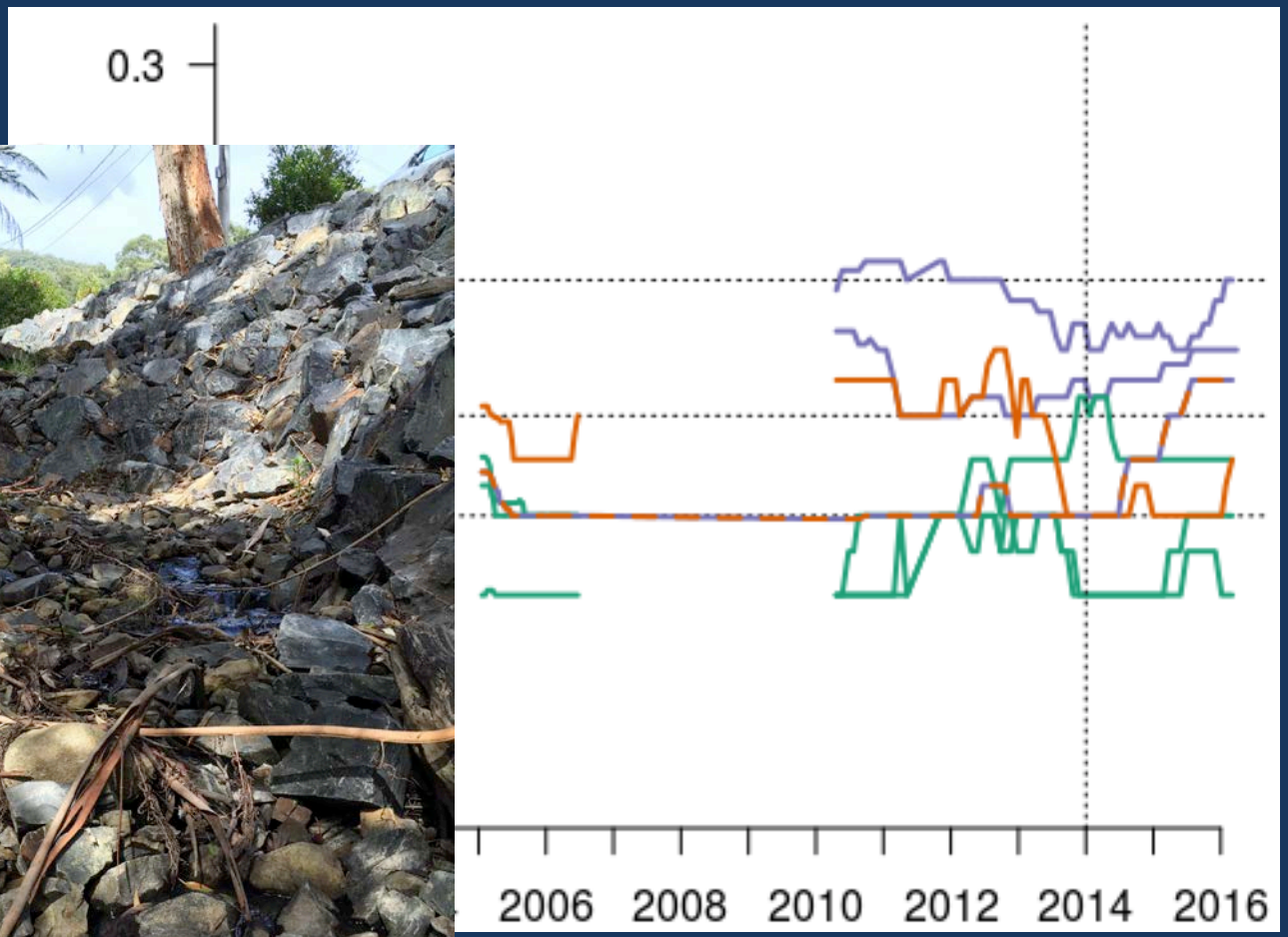
Reference
Experimental
Control

Nutrient, sediment, concentrations have declined in LSC

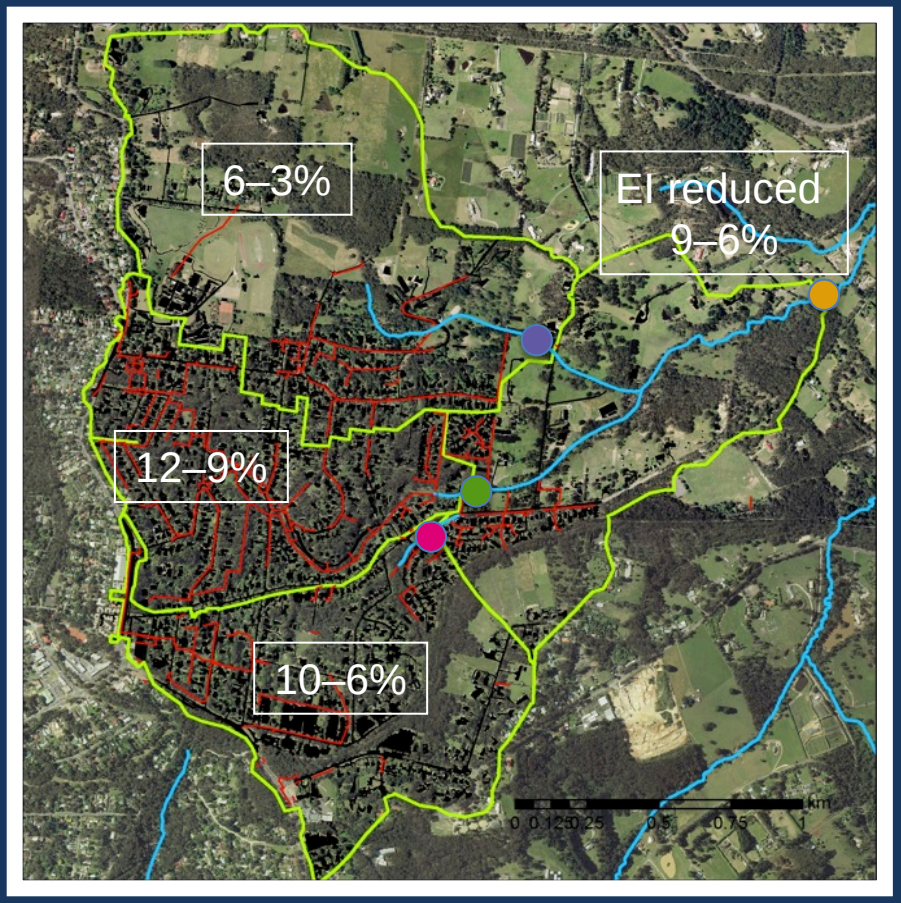
Rolling 12-month medians (vs SEPP objectives)

Reference
Experimental
Control

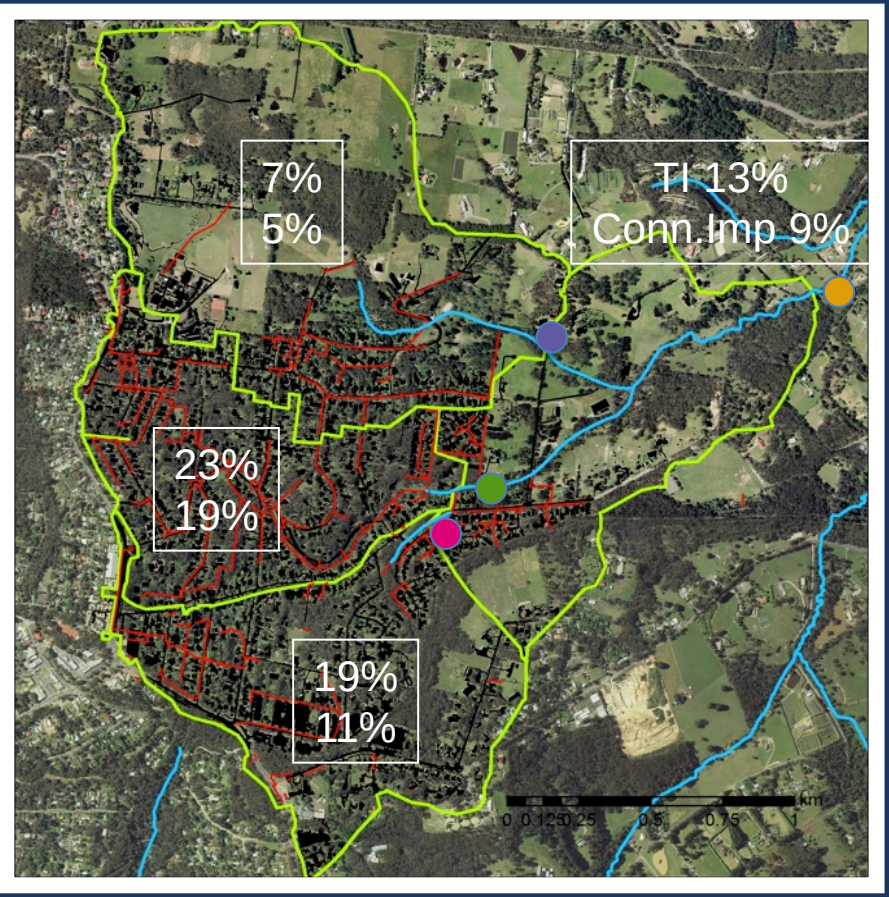
Nutrient, sediment, concentrations have declined in LSC *BUT increased in Dobsons!*

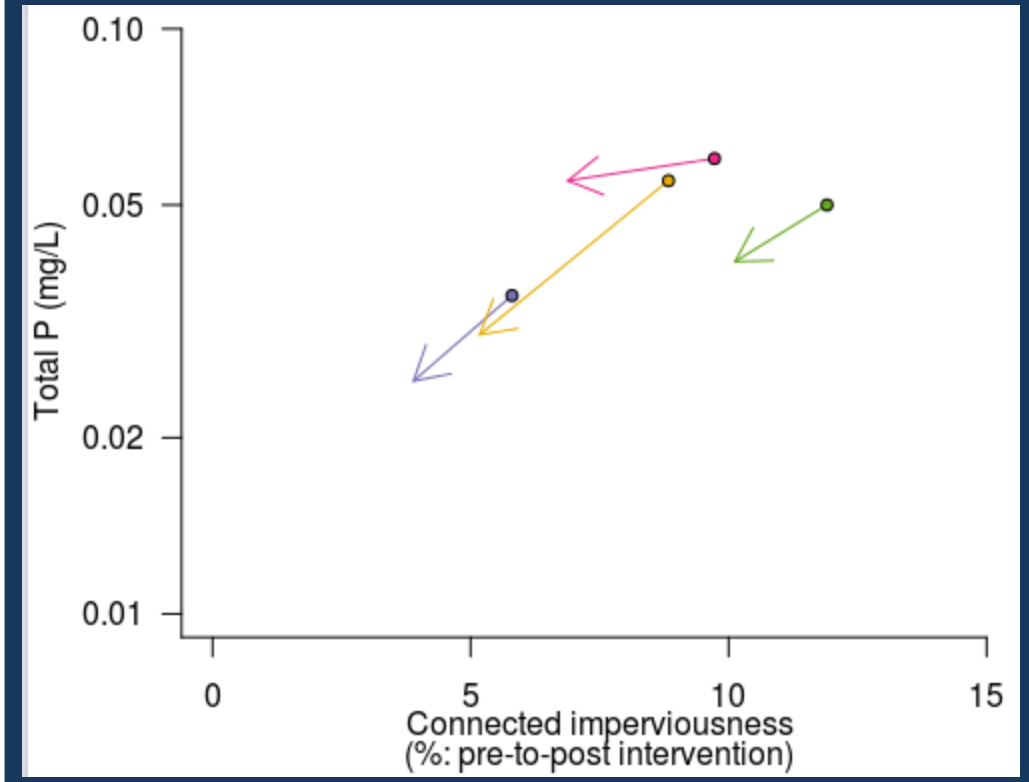


Different effects among the LSC tribs

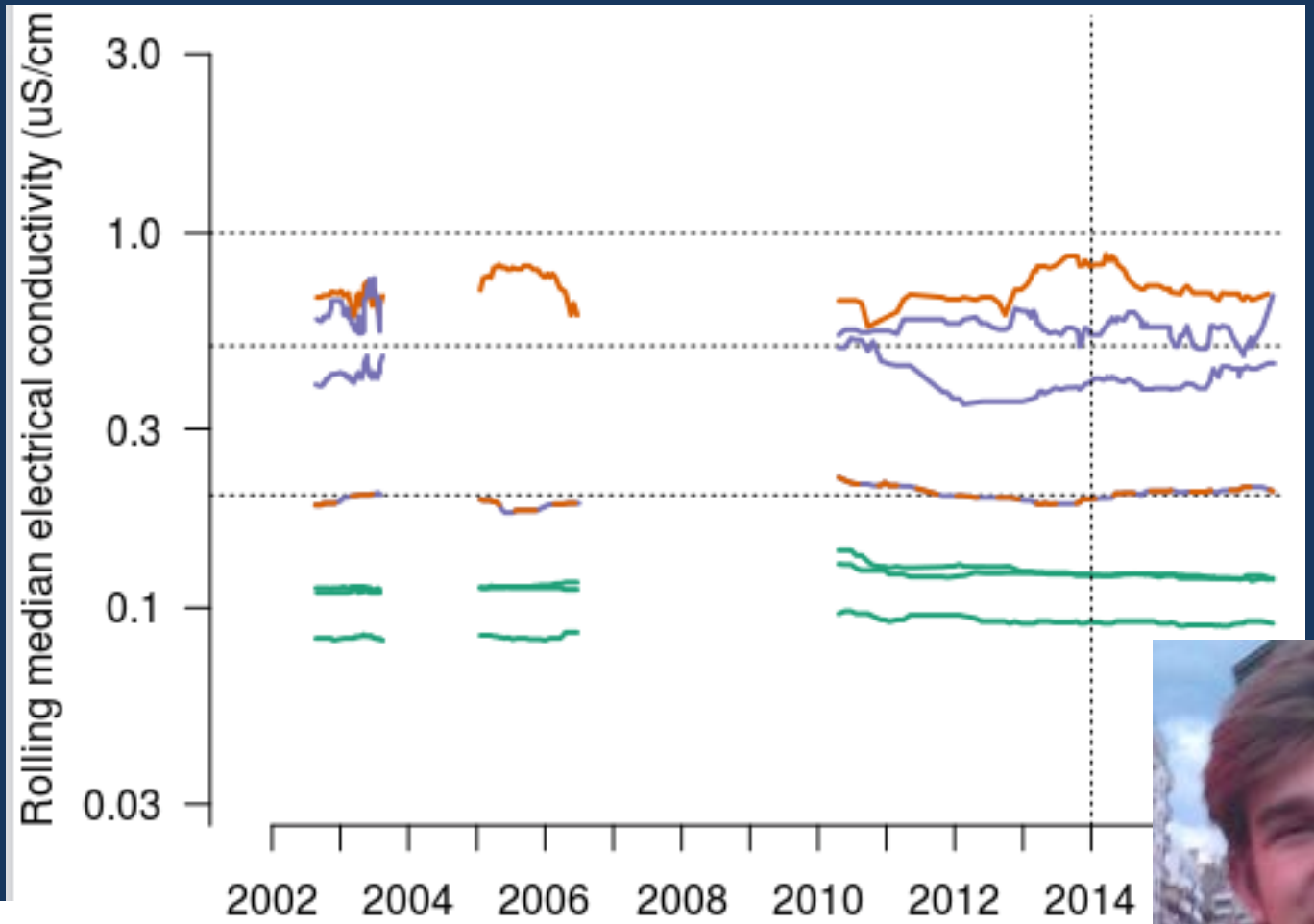


Restoration trajectories





Not all contaminants have declined (yet)



Reference
Experimental
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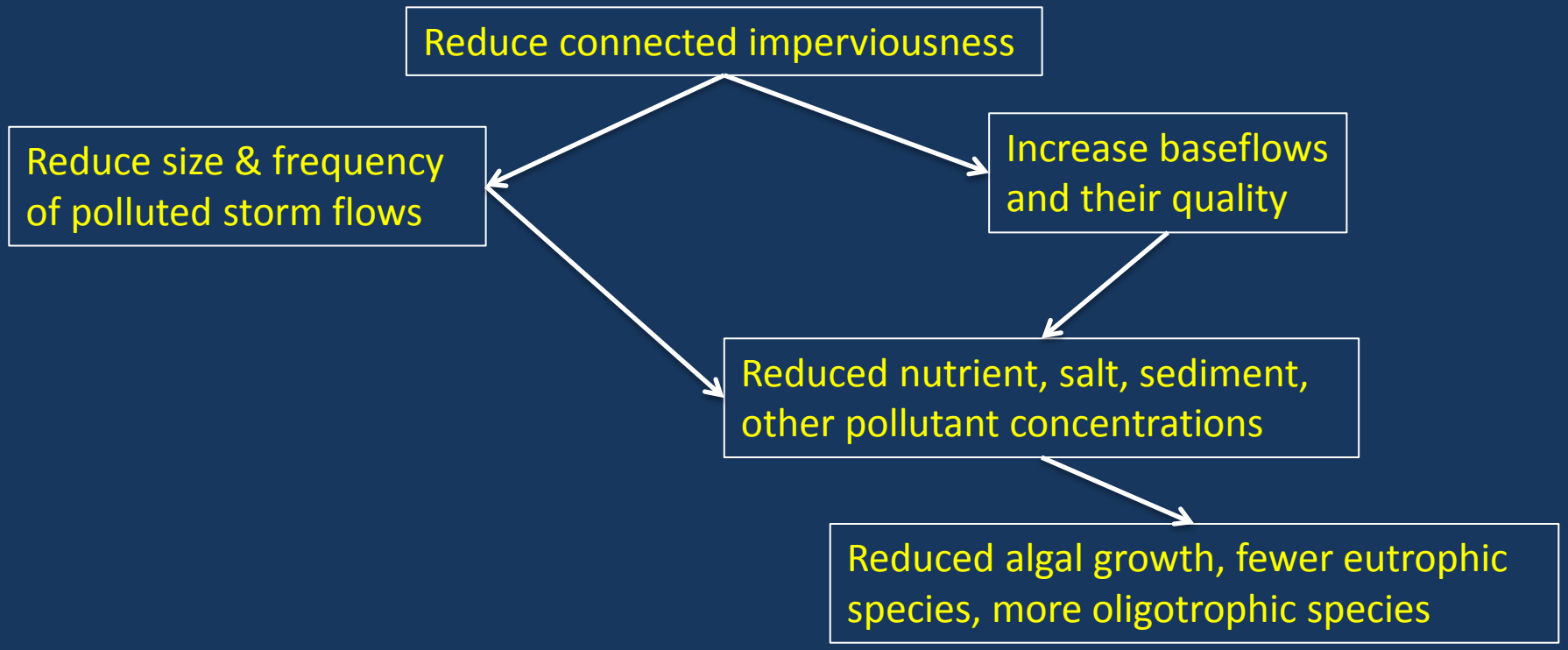
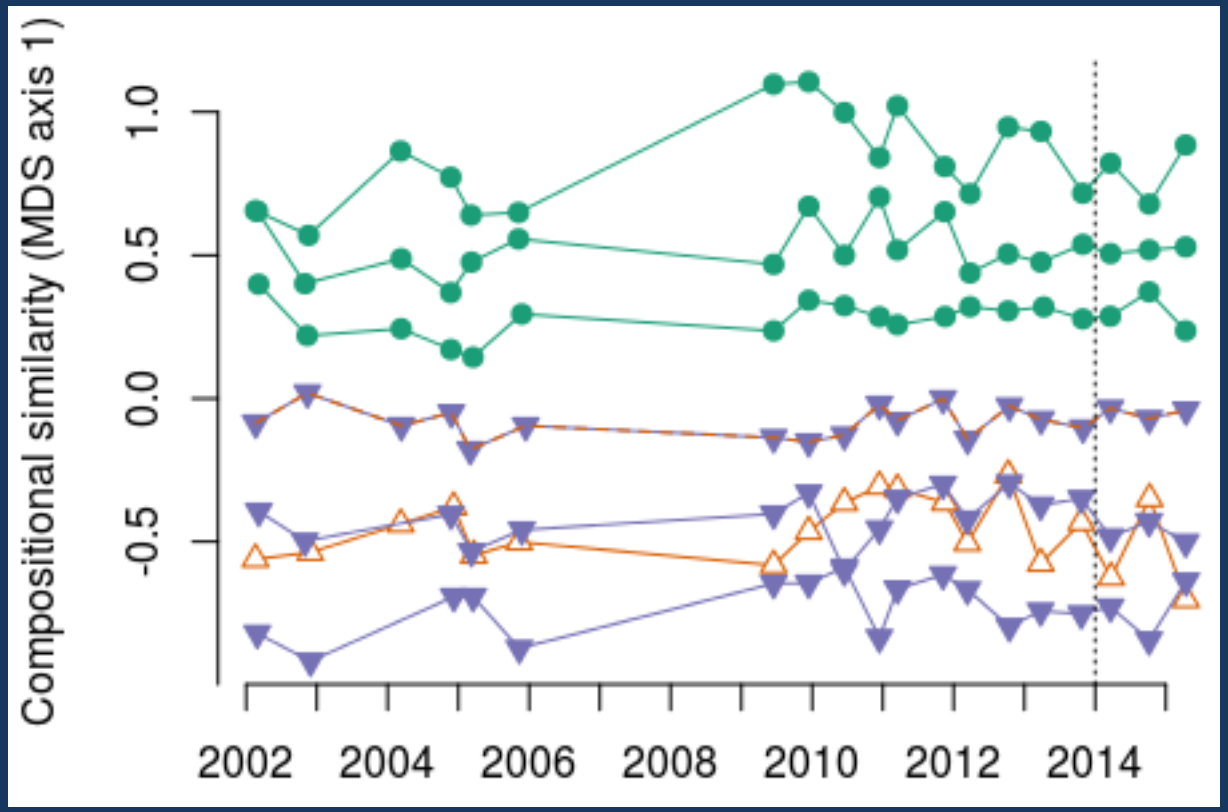
PhD student Jeremie Bonneau,
Investigating groundwater processes

Hypothesized mechanisms & responses



Algal responses

Algal biomass data analysis pending…
No strong response evident up to Autumn 2015.



Hypothesized mechanisms & responses

Reduce connected imperviousness

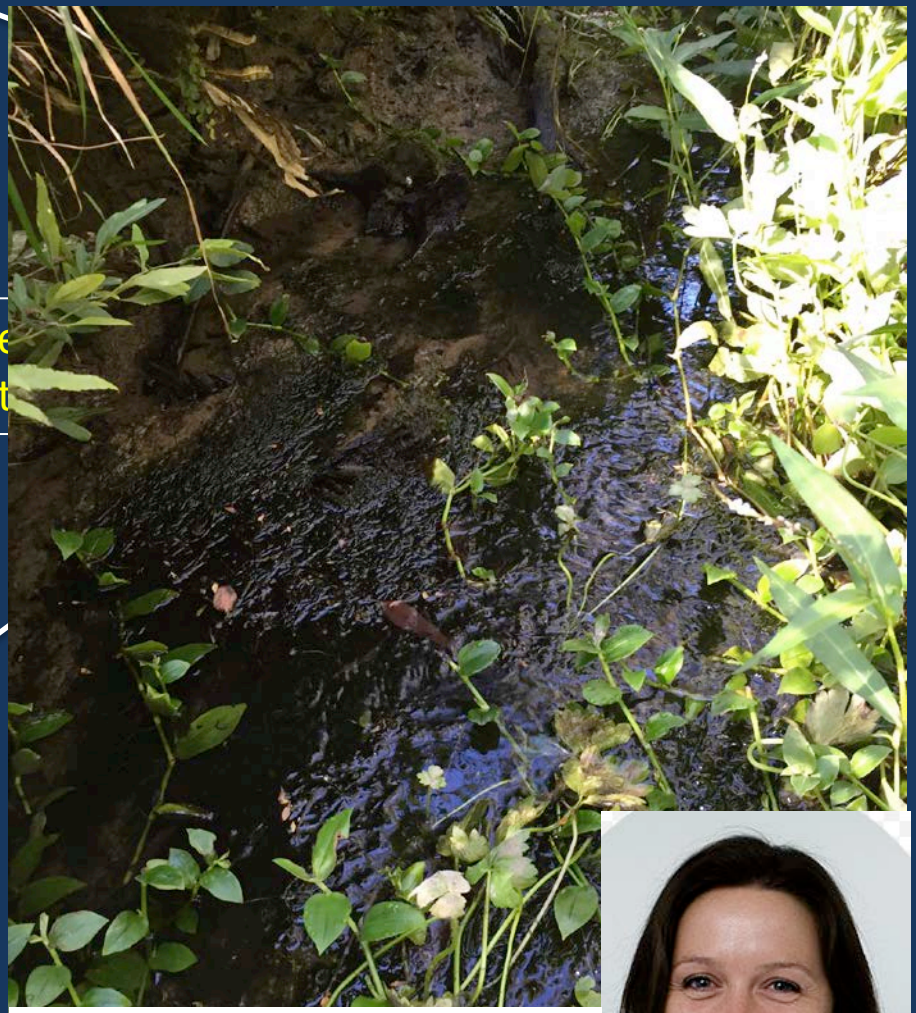
Reduce size & frequency of polluted storm flows

Reduced transport of coarse sediments

Re
ot

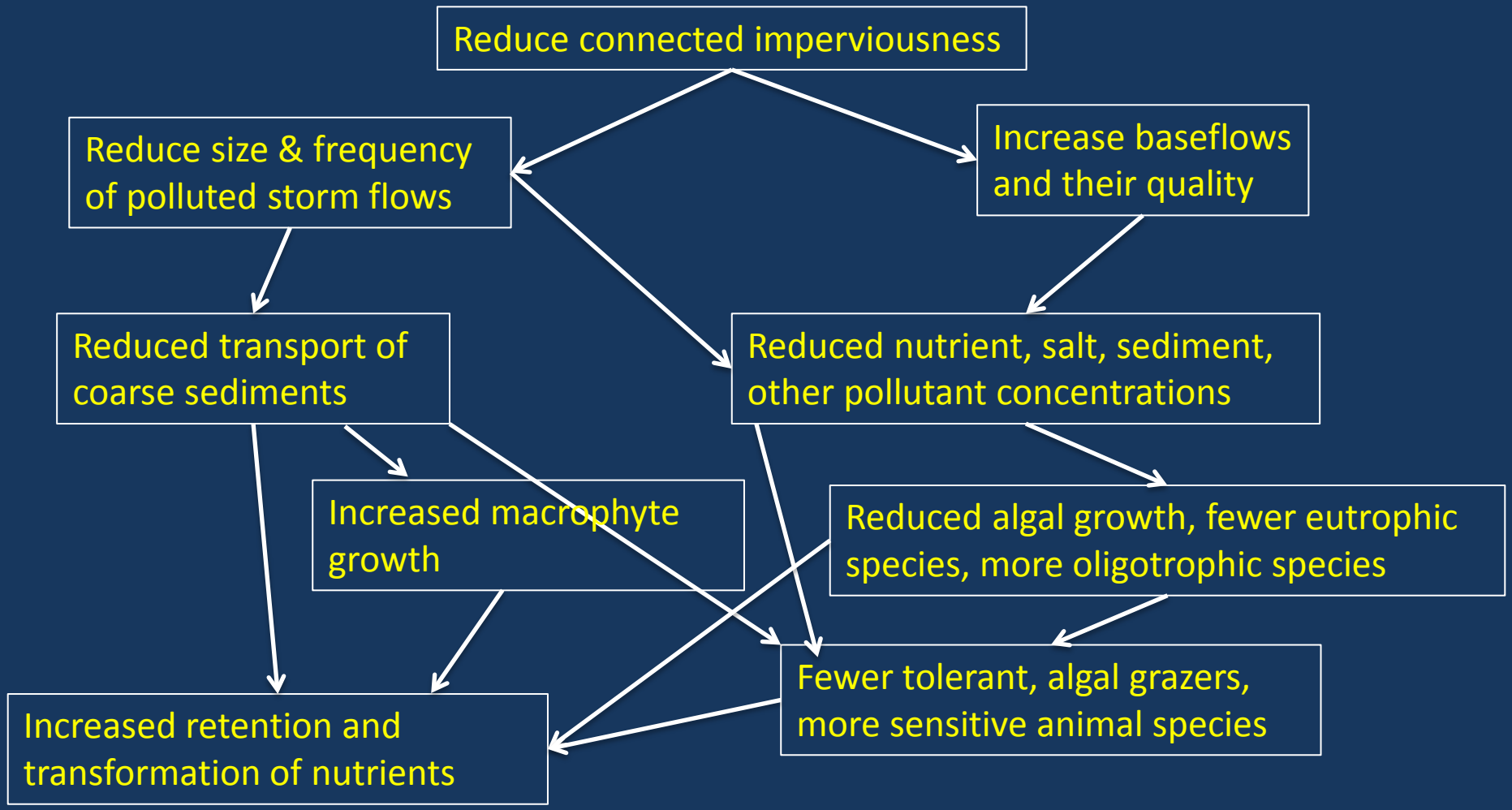
Increased macrophyte growth

Increased retention and transformation of nutrients

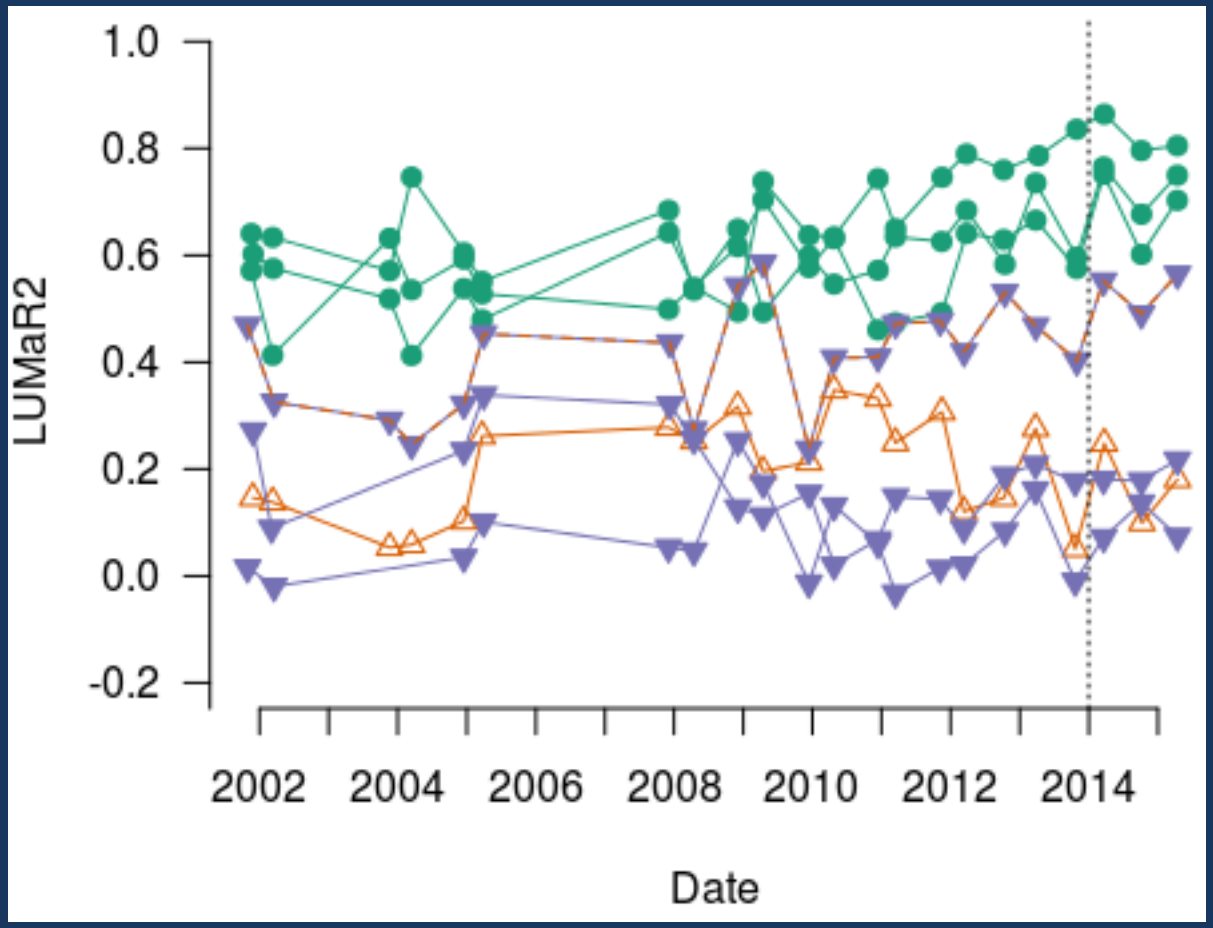


PhD student Kathy Russell, Investigating changes in sediment transport

Hypothesized mechanisms & responses



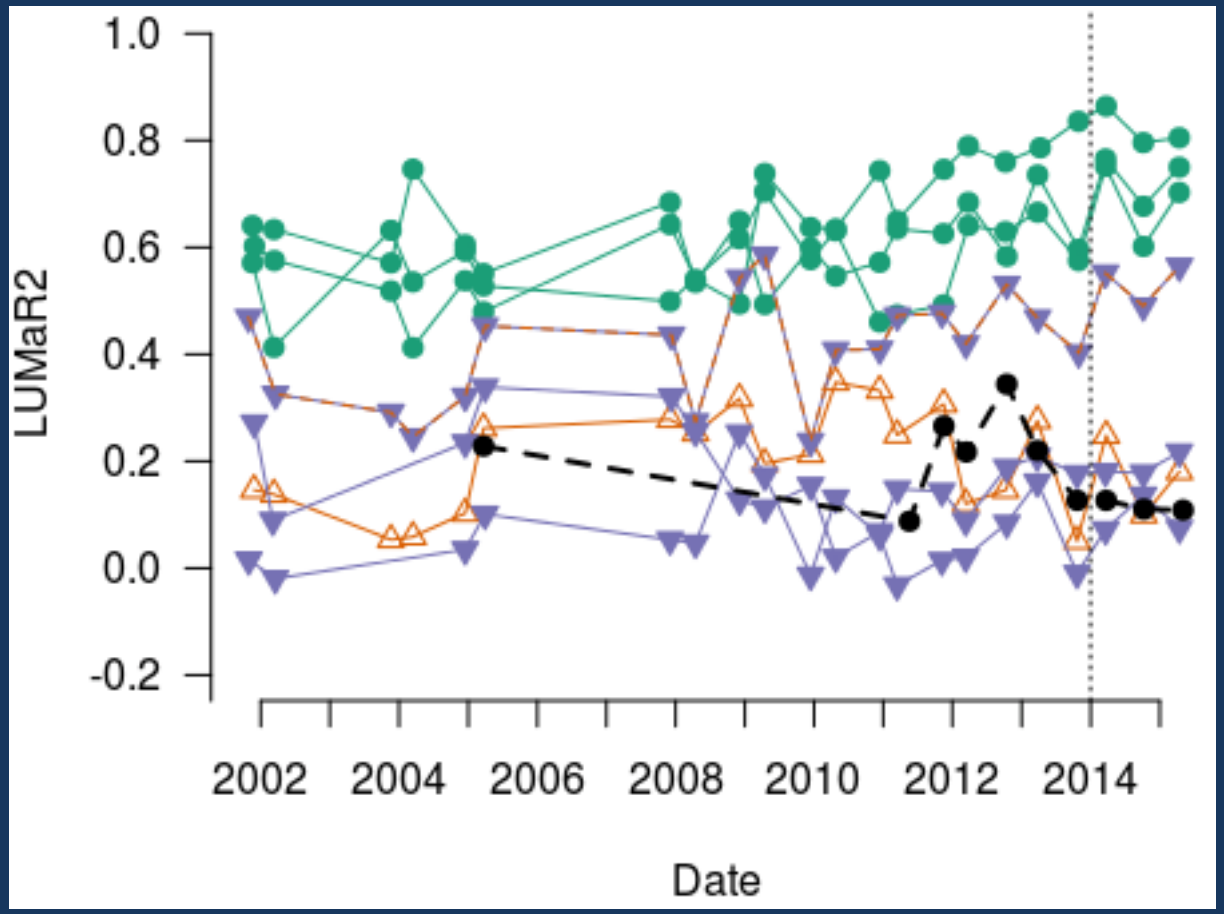
Macroinvertebrate responses



Biotic indices show no change in LSC (less variability in Dobsons?)

(Based on presence-absence: no evidence of recruitment of new species)

Macroinvertebrate responses



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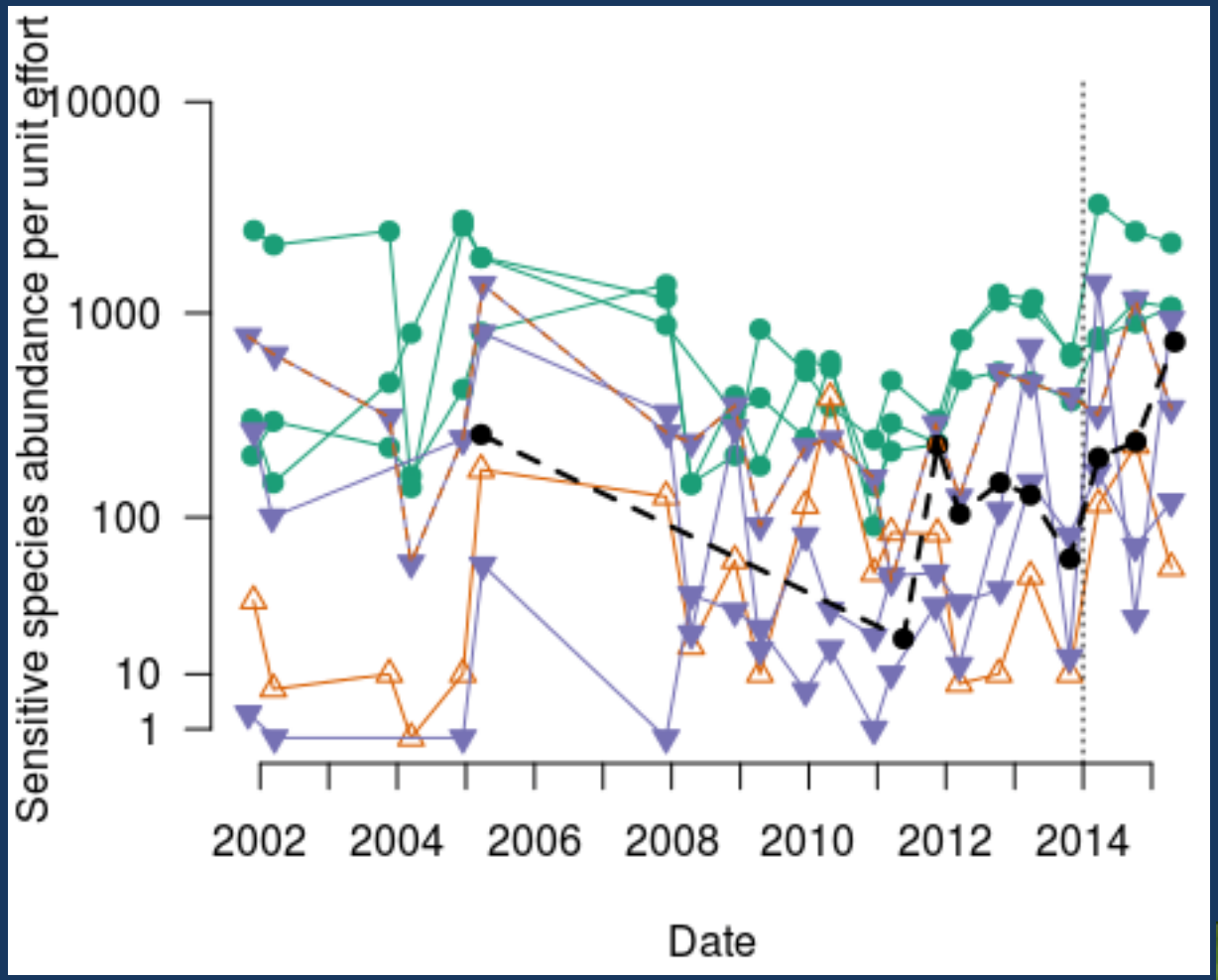
Macroinvertebrate responses



But perhaps preliminary evidence of increased abundances of the sensitive spec
have been present in small numbers.

PhD student Julia White,
Investigating macroinvertebrate assemblages

What do we know so far?

Reduce connected imperviousness

Reduce size &
of polluted st

Anecdotally perhaps.
Further analysis required

To different extents in
different subcatchments –

er reductions to
in LSC and Dobsons

it appears so –
further analysis required

Reduced transport of
coa

Anecdotally perhaps –
More sand, gravel in main
stem

Nutrients, sediments, yes.
Salinity – not yet (a legacy
effect? – further
in

n, fewer eutrophic
species, more oligotrophic species

No response to Autumn
2015

Possibly (Mass-balance estimates
eeded to assess if P, N in main
than can be explained by
eductions in tribs)

azers,
pecies

Increa
transf

No recruitment of new
sensitive spp; Increased
abundances of existing
sensitive spp. Further
monitoring required.

Reduced microbial leaf-breakdown (rotting),
increased shredding of leaves by invertebrates

required

Conclusions

At-source stormwater retention can reduce flow and water quality disturbances to receiving streams

Lots of socio-econo-political lessons …(just one for now)

Our ability to implement control measures limited by a lack of public land – The importance of reserving drainage lines at the planning stage

Flow and WQ changes appear enough to elicit biological responses (further analysis required),
But perhaps responses delayed by a lack of recruits (will they come?)
A lack of salinity response points to the importance of groundwater flows (longer-term WQ responses to come?)
Biological responses could also be limited by geomorphic degradation (Sediment dynamics)