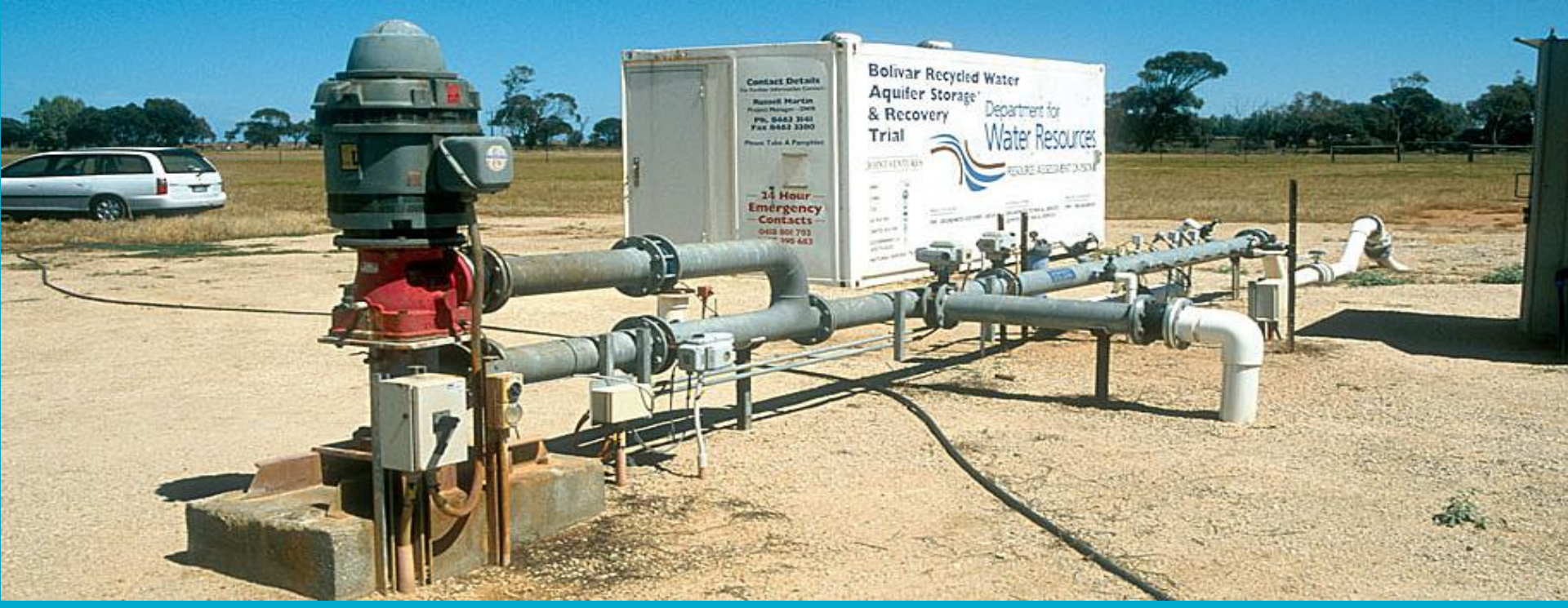


Bolivar recycled water ASR

Key findings

Joanne Vanderzalm | Team Leader, Liveable Sustainable and Resilient Cities

27 January 2016

ASR
AQUIFER STORAGE
AND RECOVERY

LAND AND WATER
www.csiro.au

SA WATER

Government
of South Australia

PRIMARY INDUSTRIES
AND RESOURCES SA

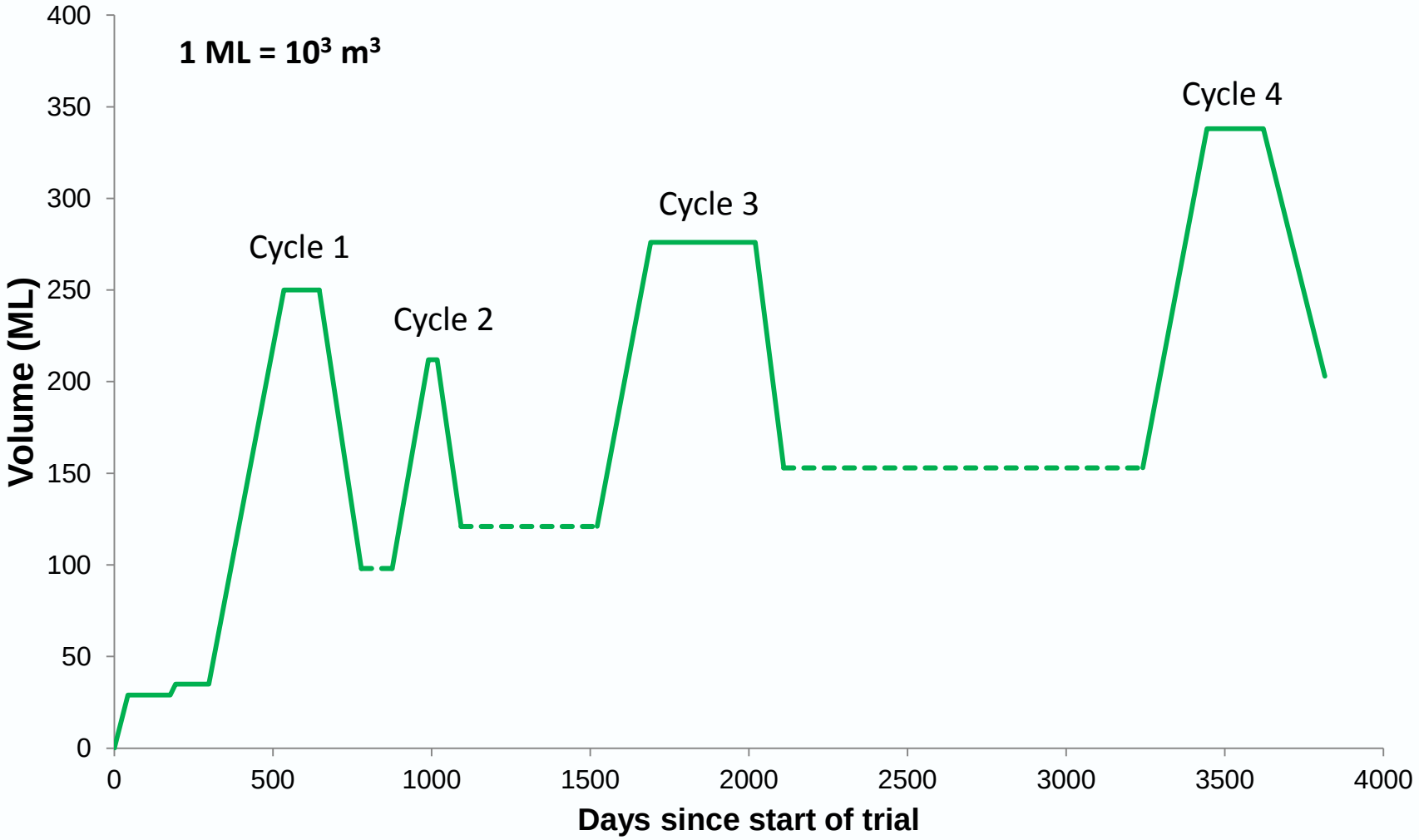
United Water

Centre for
Groundwater Studies

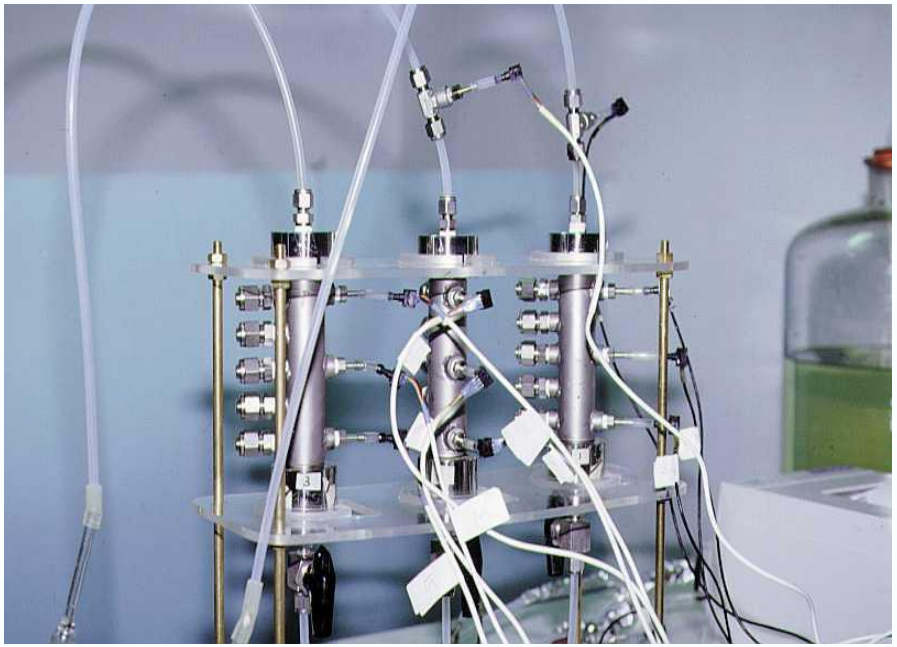
CSIRO

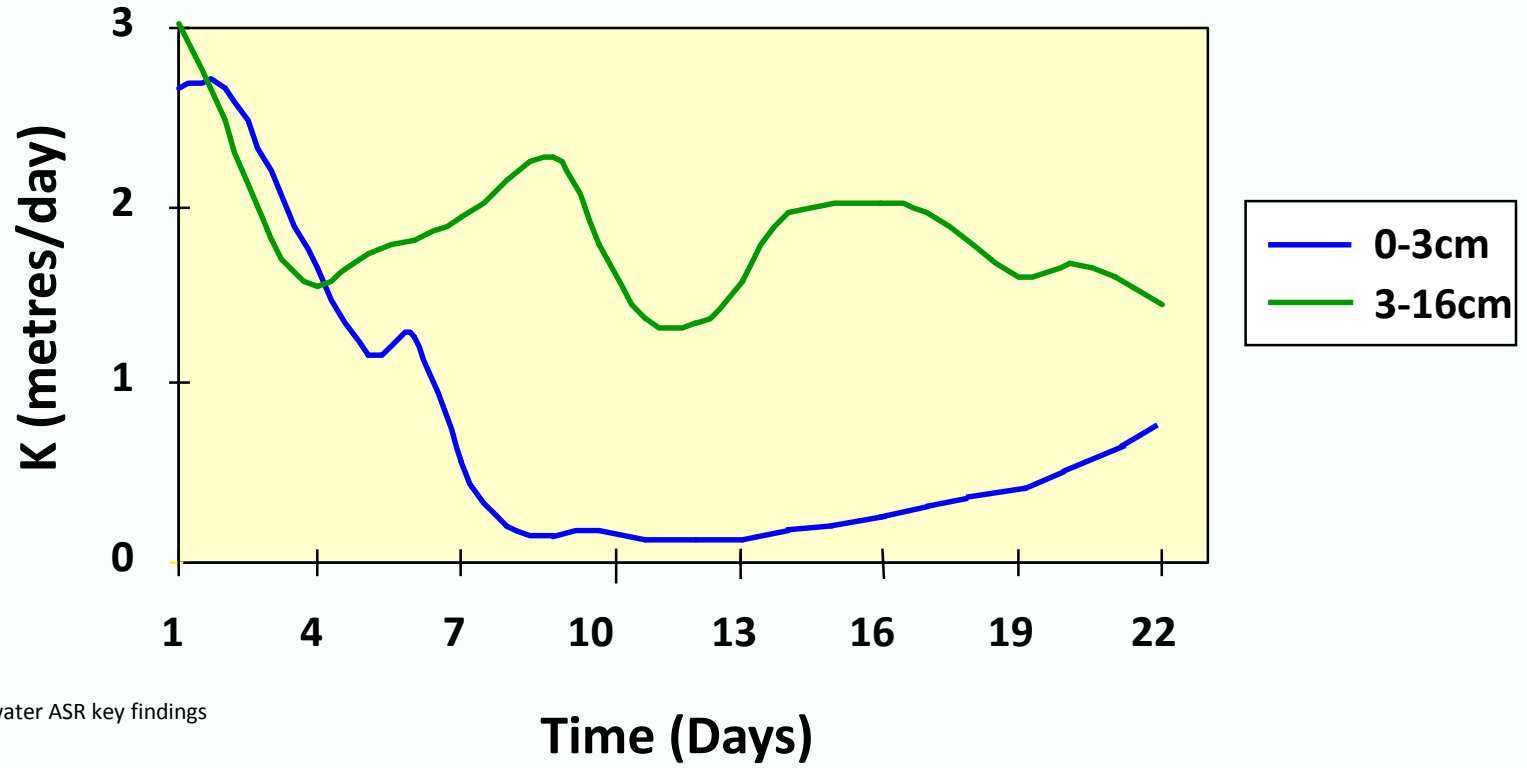
Water balance – Oct 1999 to Mar 2010

704 ML injected and 501 ML recovered over four ASR cycles

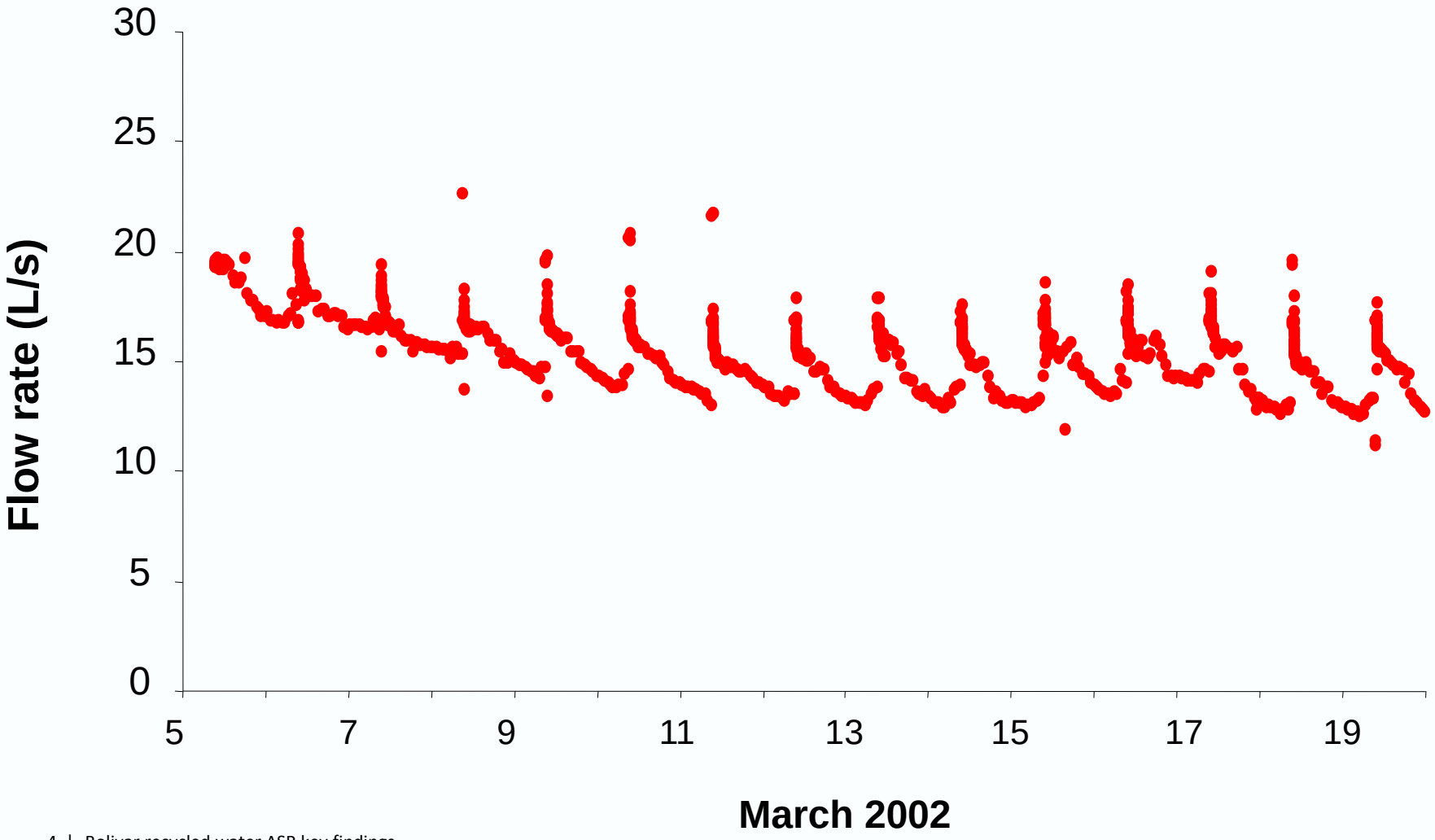


Assessing potential for clogging of well using laboratory columns of aquifer material



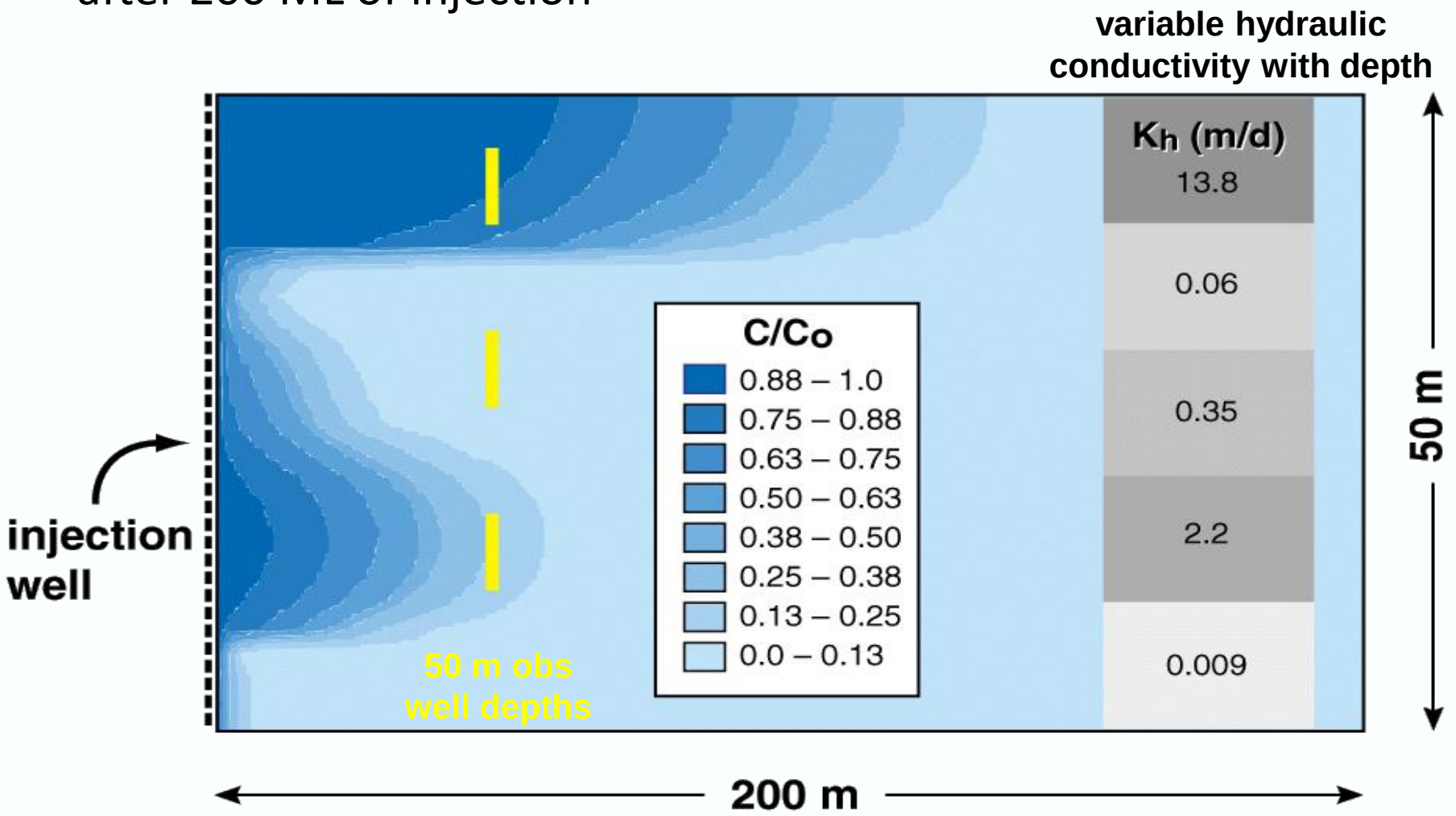


Variations in injection rate due to transient hydraulic gradients, clogging, and clogging management

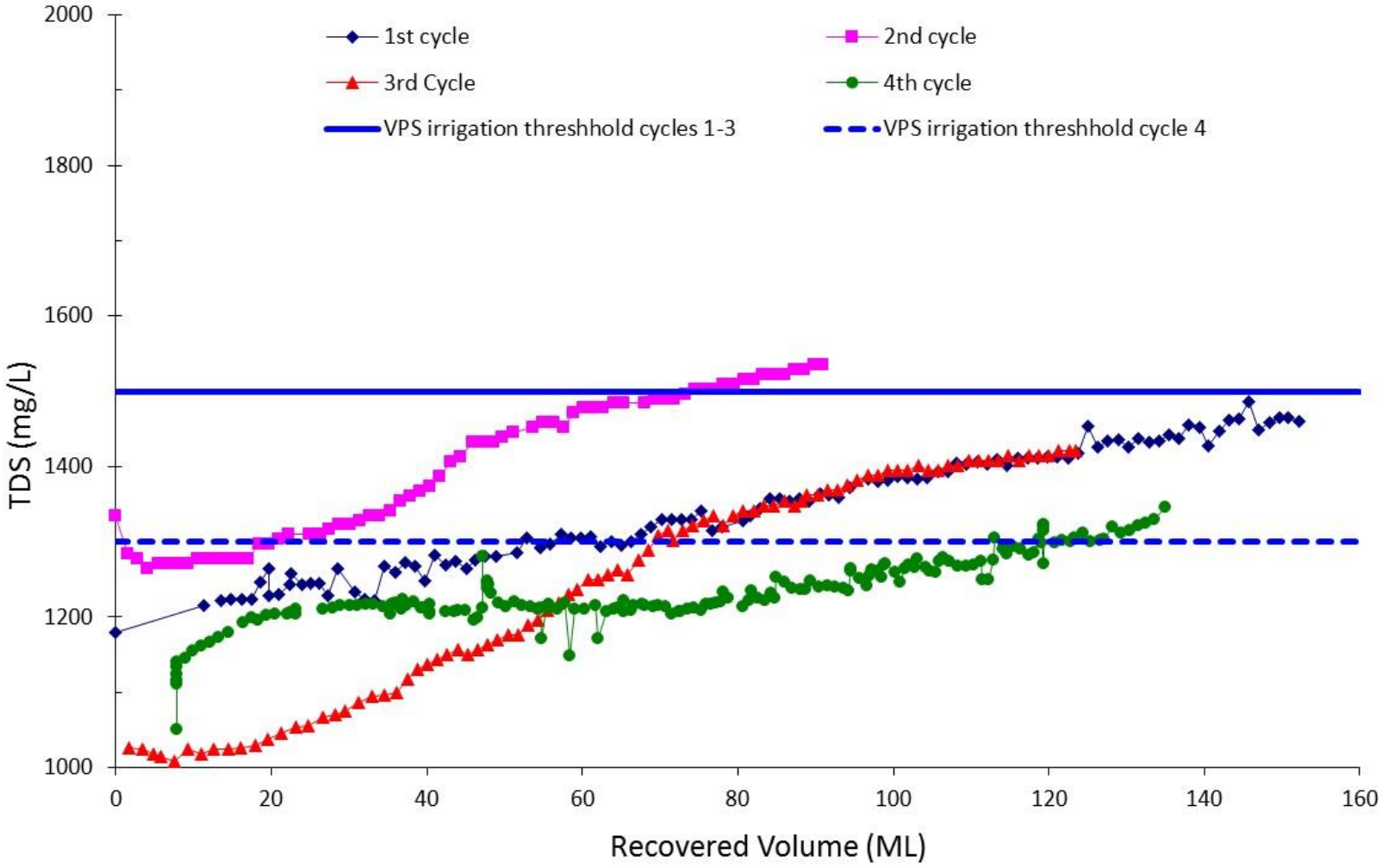


Where will water go?

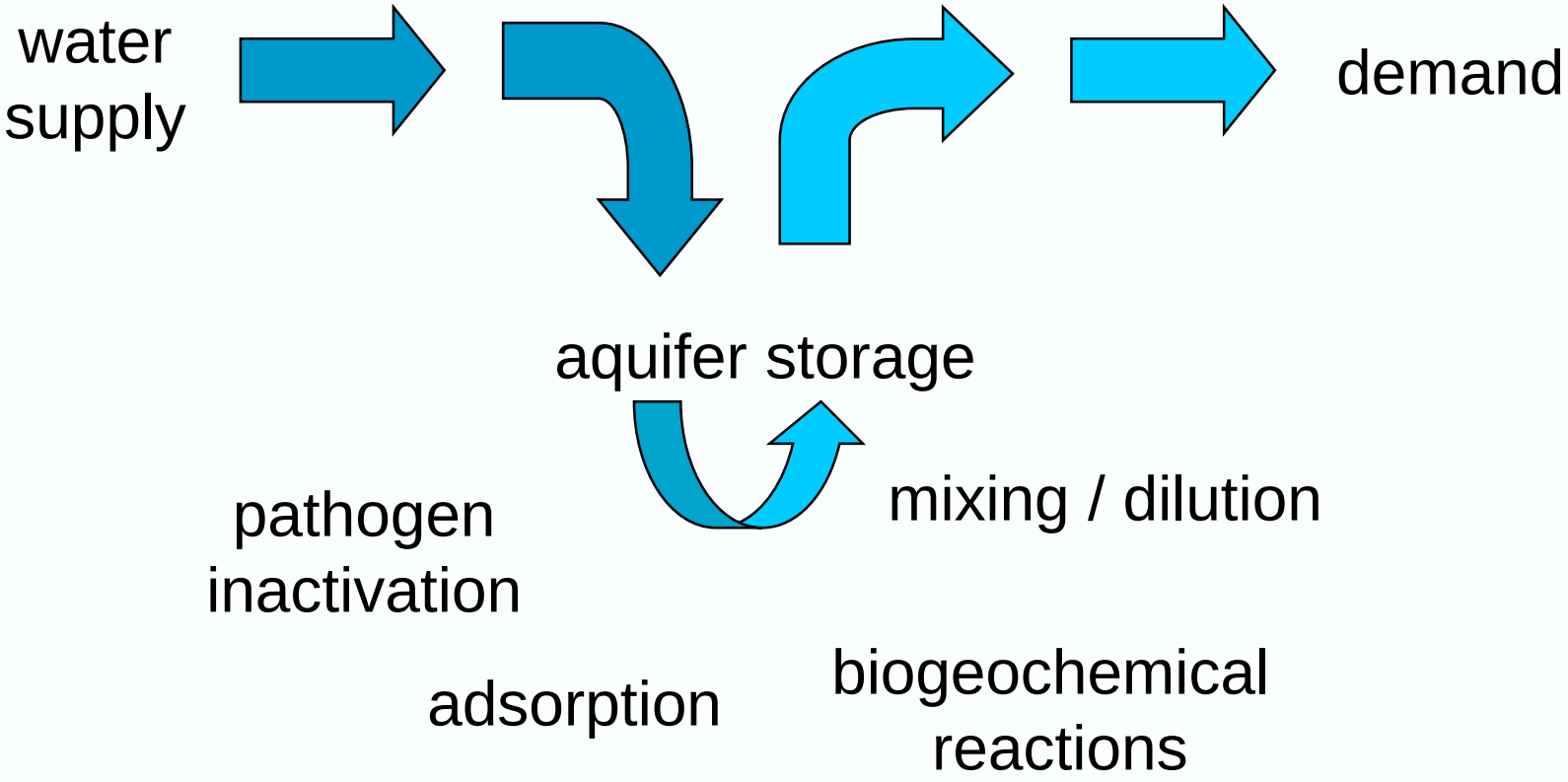
Predicted distribution of injectant on a radial vertical cross-section after 200 ML of injection



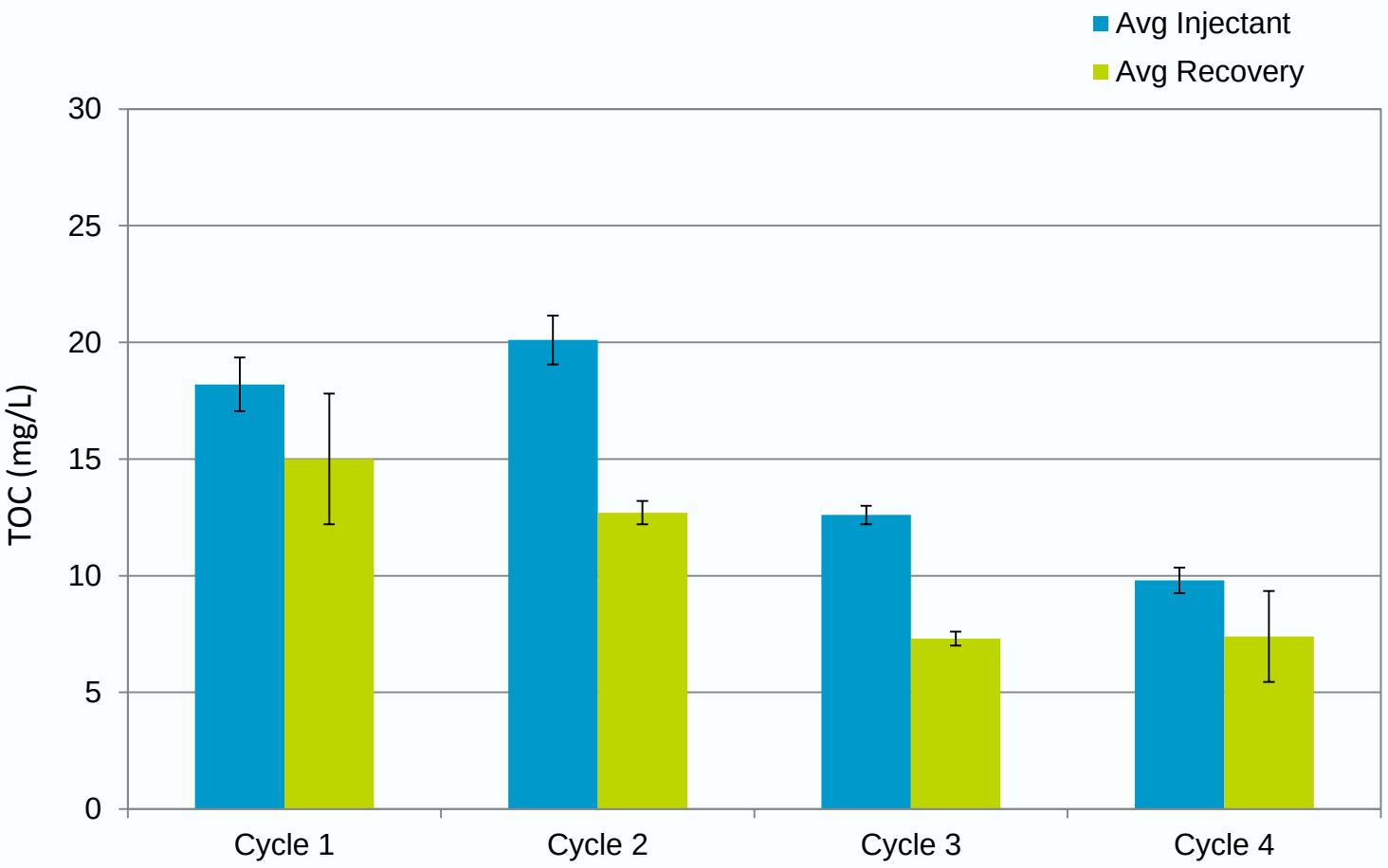
Salinity increase during recovery phase



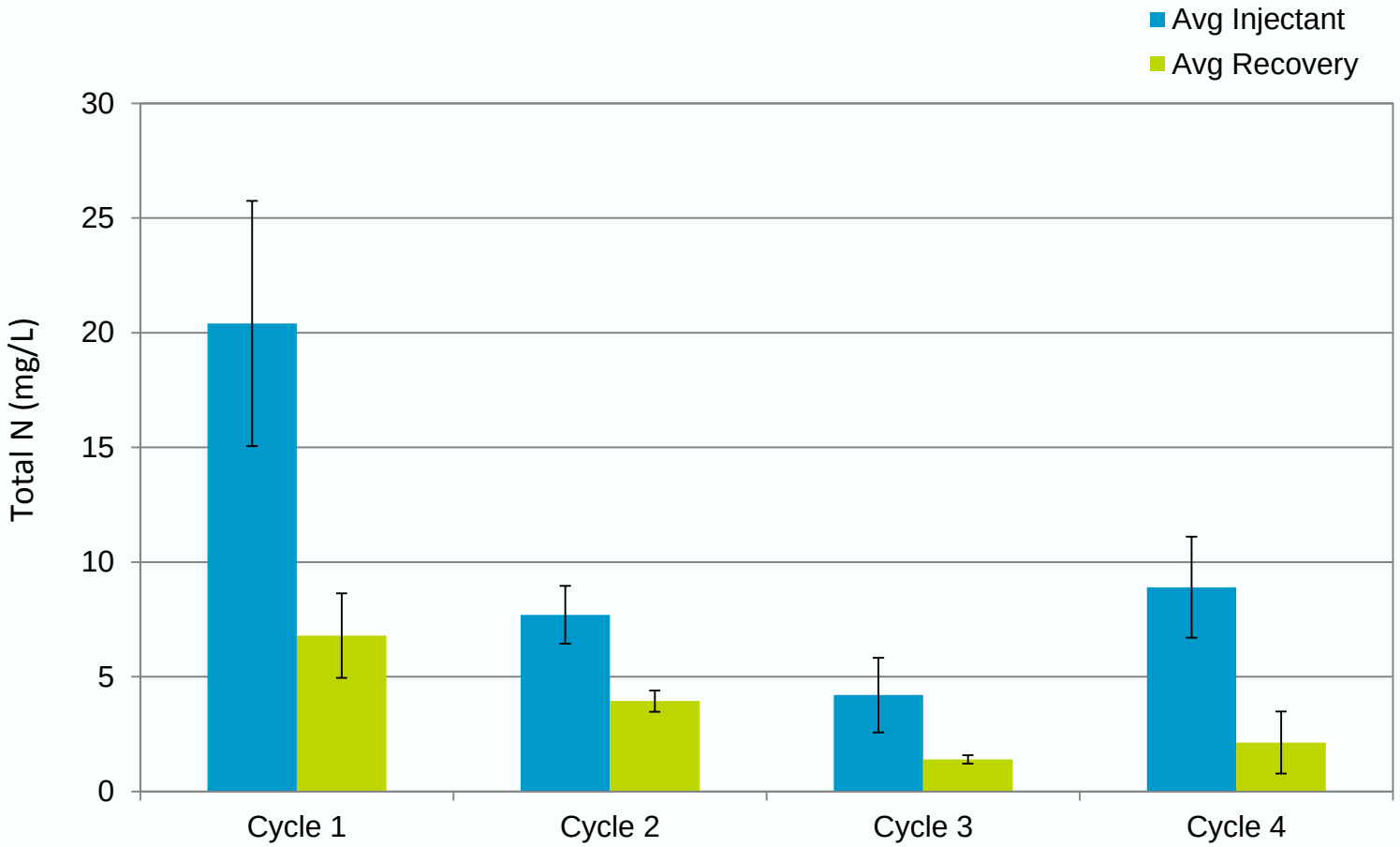
Aquifer treatment processes



Total Organic Carbon ~ 20% removal



Total Nitrogen ~ 70% removal



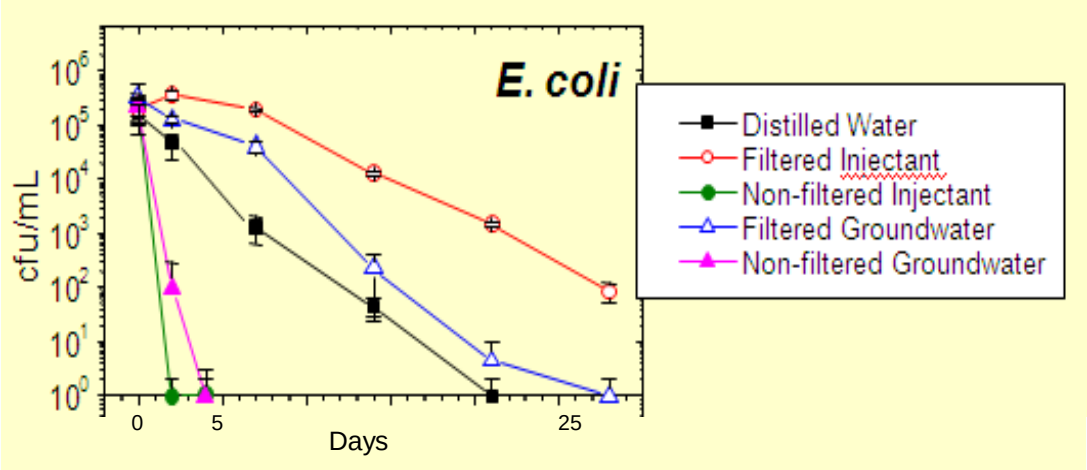
Fate of pathogens

Laboratory studies and *in-situ* pathogen survival chambers

Virus species
adenovirus, rotavirus, coxsackievirus and the bacteriophage MS2

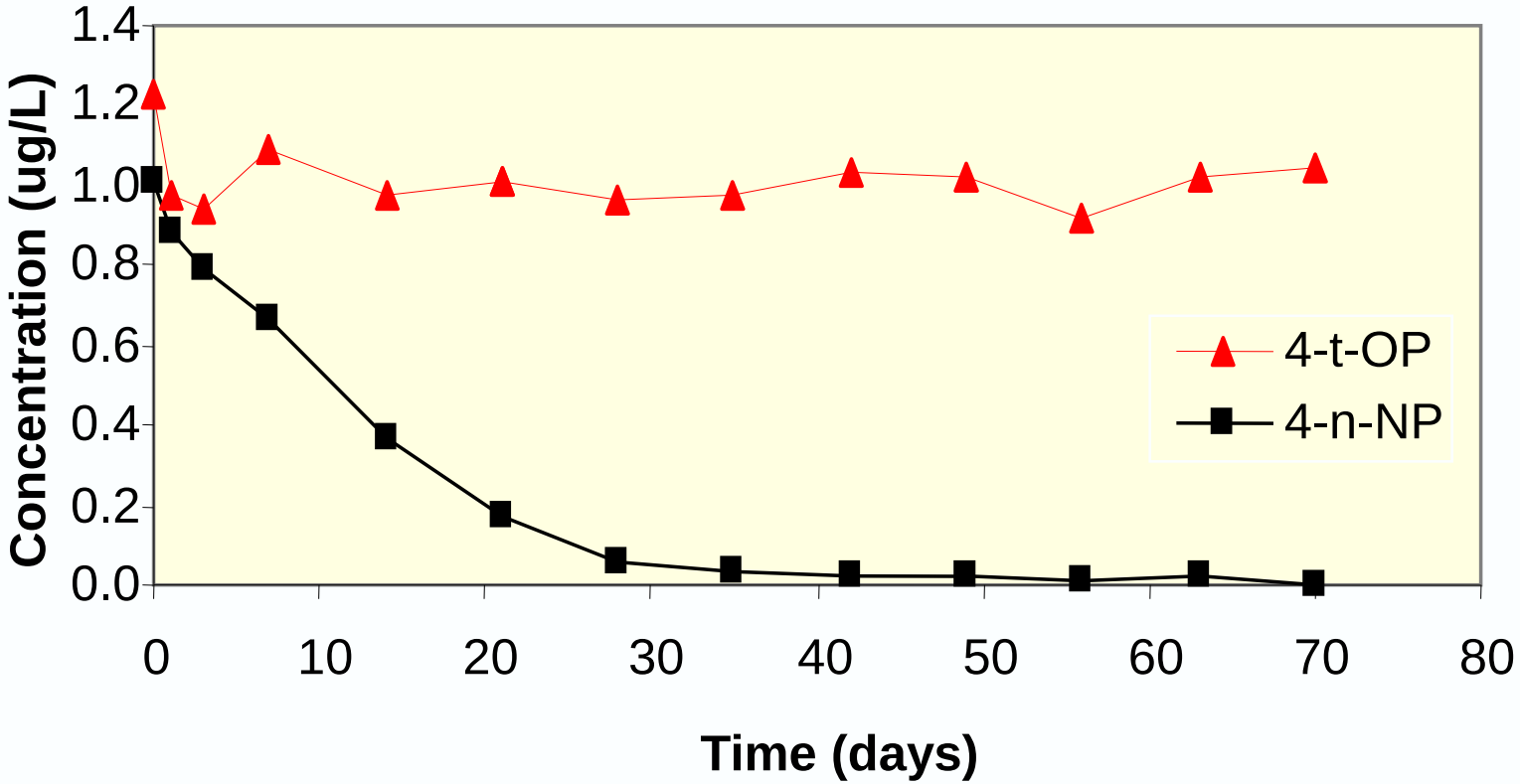
Protozoa
Cryptosporidium

Bacterial species
Campylobacter jejuni, *Salmonella*, *E. coli* and *E. facalis*



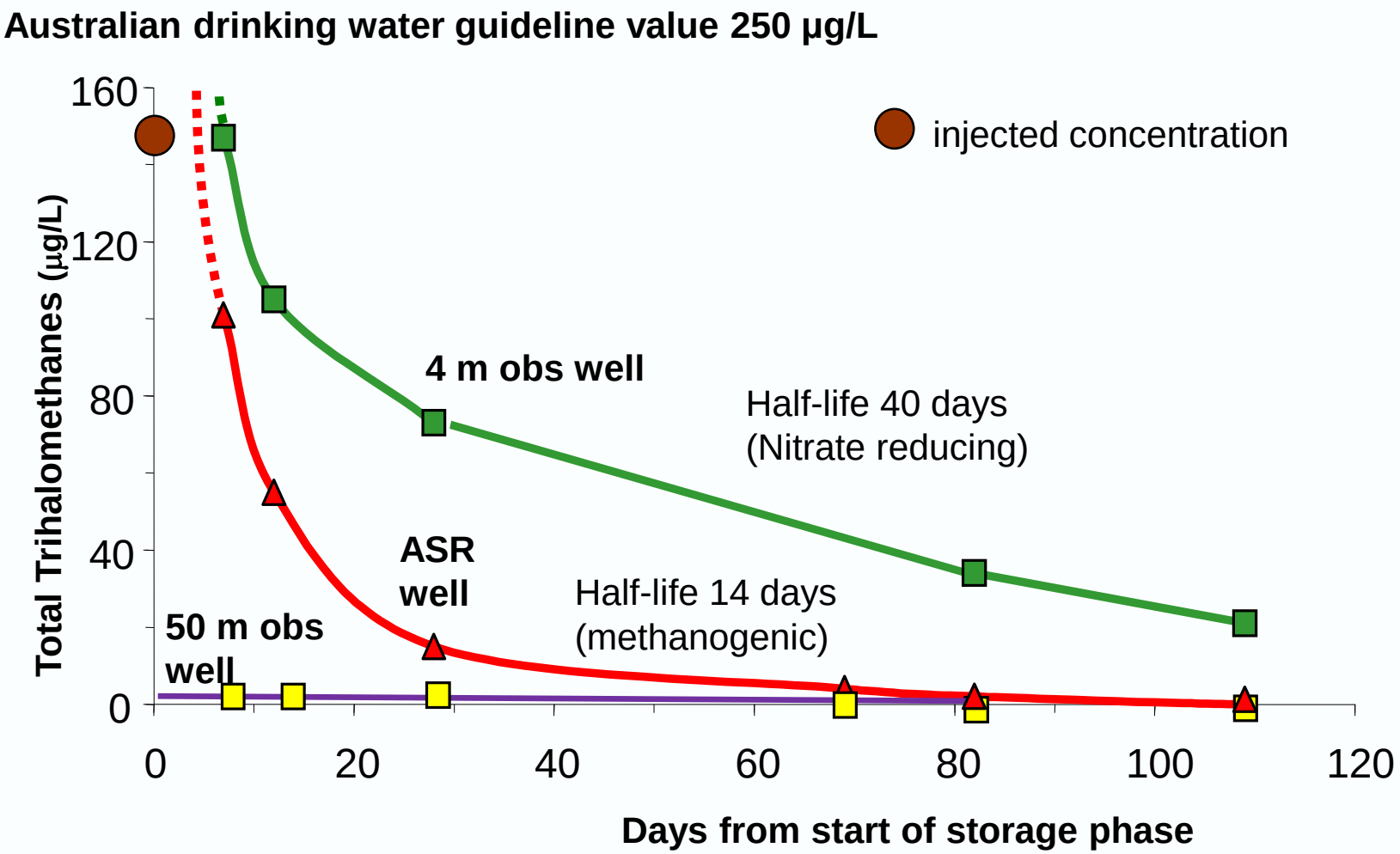
Laboratory study of *E. coli* decay in sterile (filtered) and non-sterile groundwater or injectant

Laboratory study of trace organic chemical fate e.g. endocrine disruptors

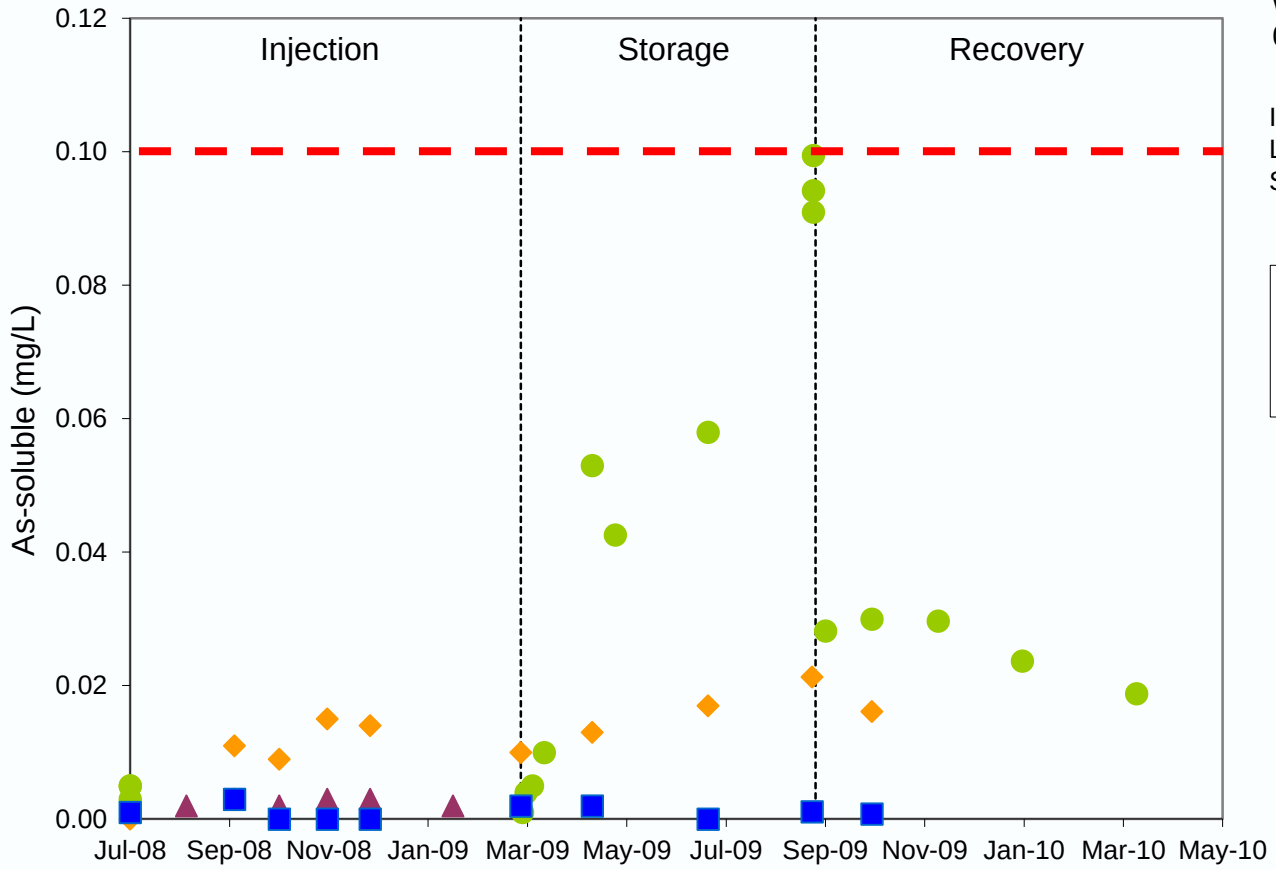


4-t-OP = 4-tert-octylphenol
4-n-OP = 4-n-nonyphenol
Treatment : Aerobic conditions without co-metabolite (organic carbon)

Fate of disinfection byproducts



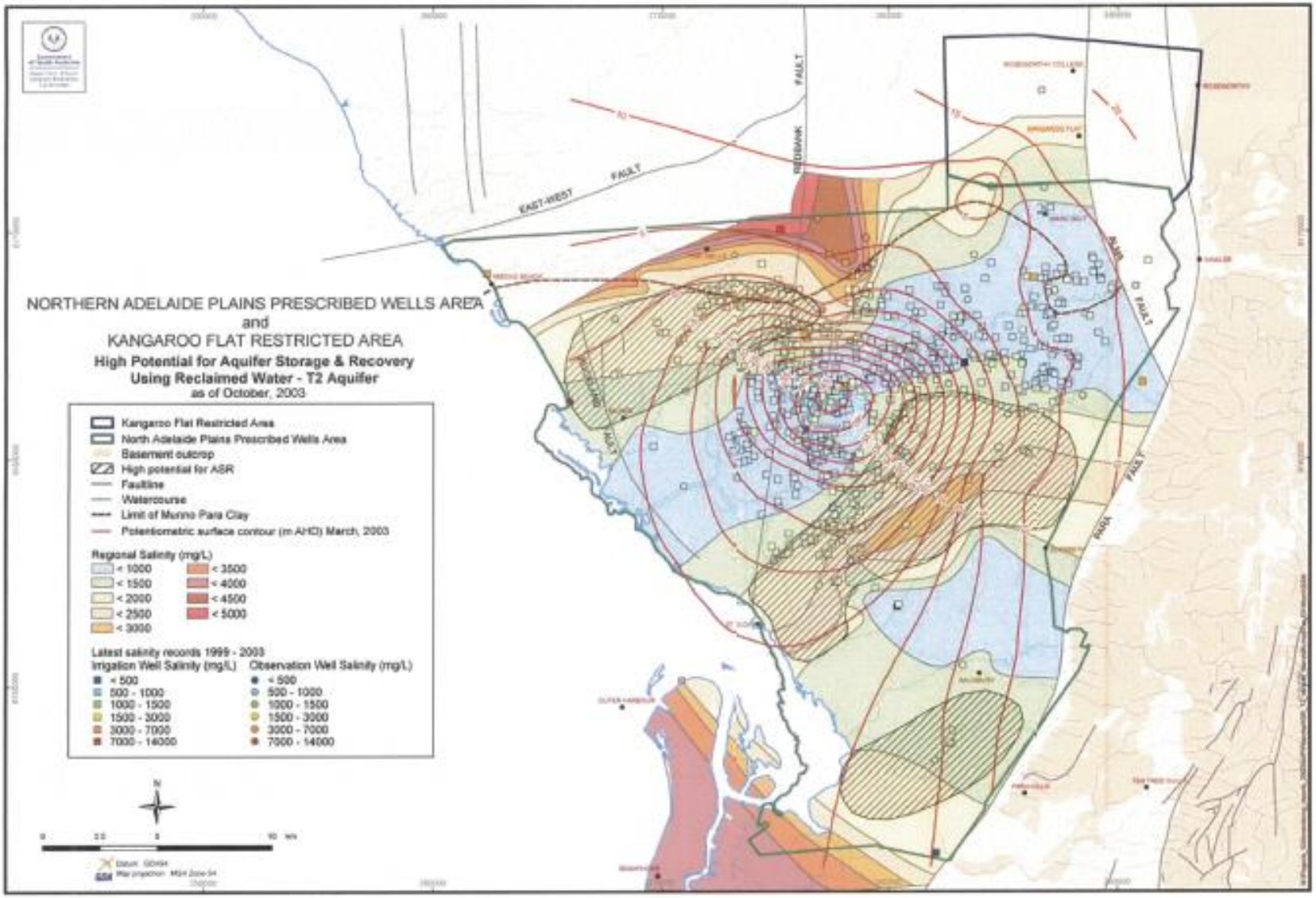
Fate of metals – Arsenic mobilisation



Australian drinking water guideline value 0.010 mg/L

Irrigation
LTV = 0.1 mg/L
STV = 2.0 mg/L

Regional groundwater flow modelling



Martin and Dillon, 2005

Conclusions

- Australia's first reclaimed water ASR trial is technically, environmentally and economically viable
  - Clogging was demonstrated to be manageable
  - Recovered water quality was found to be fit for irrigation supplies
  - Recovery efficiency exceeded 80%
  - No evidence of any degradation of the environmental values of the aquifer, and no adverse impact on any other groundwater user
  - Dissolution of calcite will not adversely impact on the normal operating life of the ASR well, nor destabilise the overlying aquitard (design life >100 years)
- Improved knowledge of aquifer treatment processes and developed sound operating practices and ability to predict changes
- Science underpinning national MAR Guidelines

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