



Mobilisation of metals and acidity during refilling of a dried wetland: a comparison of rapid metal-release and field data

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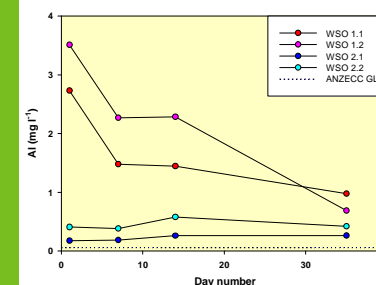
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Ecosystems and Contaminants Theme, Water for a Healthy Country Flagship
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Range of laboratory methods used to assess/predict metal release of dried wetland soils

- Simple dissolution tests with de-ionised water or natural river/lake water
- Dynamic tests e.g. batch experiments over a specified time period to predict longer term trends
- Soil core studies with manipulation of flows/heads



Can we use the data to make a reasonable prediction ?



What do the numbers mean for soil pore water, for groundwater and for overlying surface waters ?

Chemical variability – structural variability – hydrological scenario dependence

Are they appropriate to make predictions of impacts so that we can generate positive outcomes ? Are they relevant for ecotoxicological predictions ?

Lack of wetland case studies to help underpin determination of risk
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Closure during drought in SE Australia



November 2007



April 2008



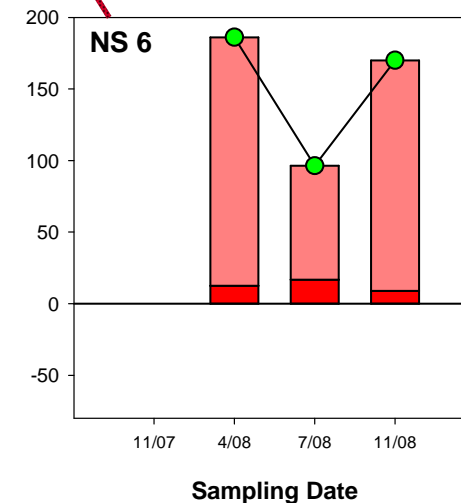
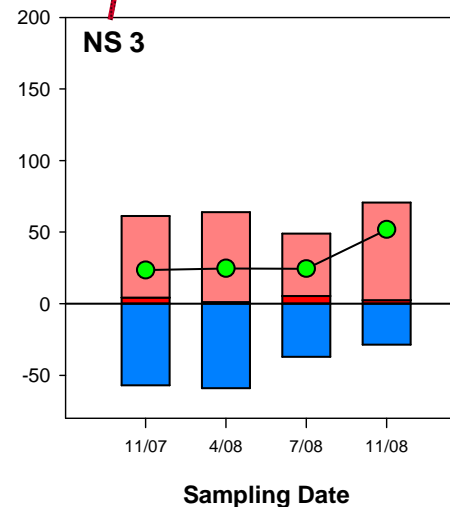
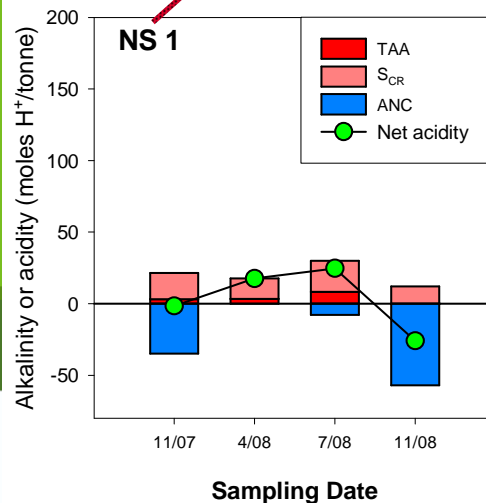
July 2008



November 2008

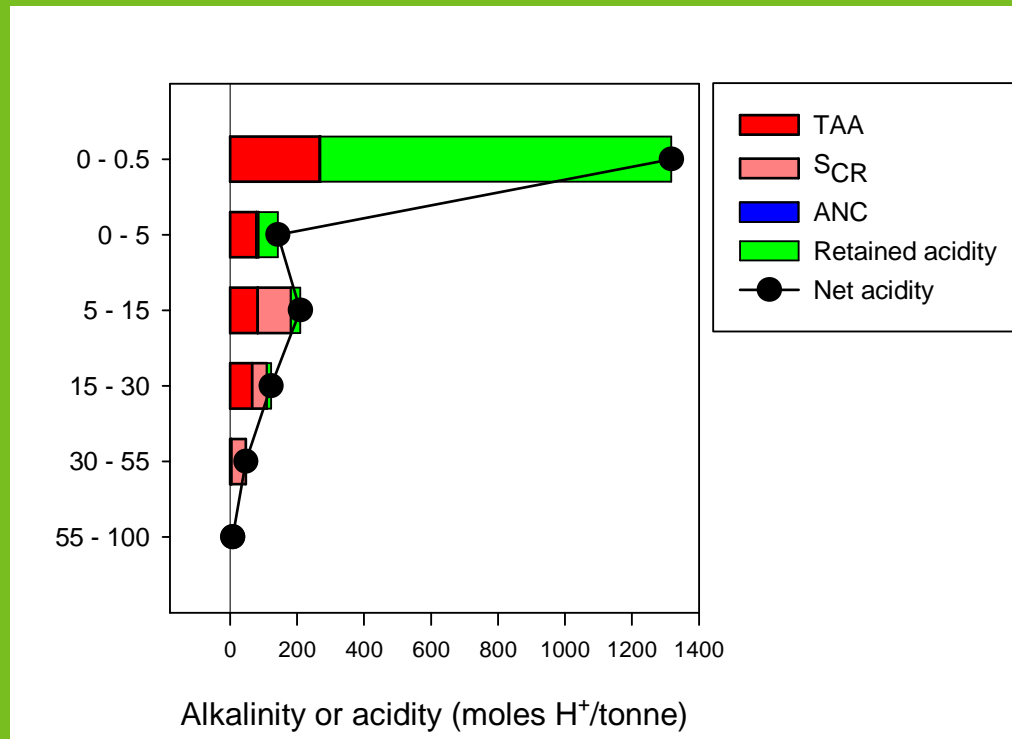
Decrease in S_{Cr} at surface over time

Soil acidification – shallow sulfuric above hypersulfidic materials at depth



What happens to the acidity and sulfate ?

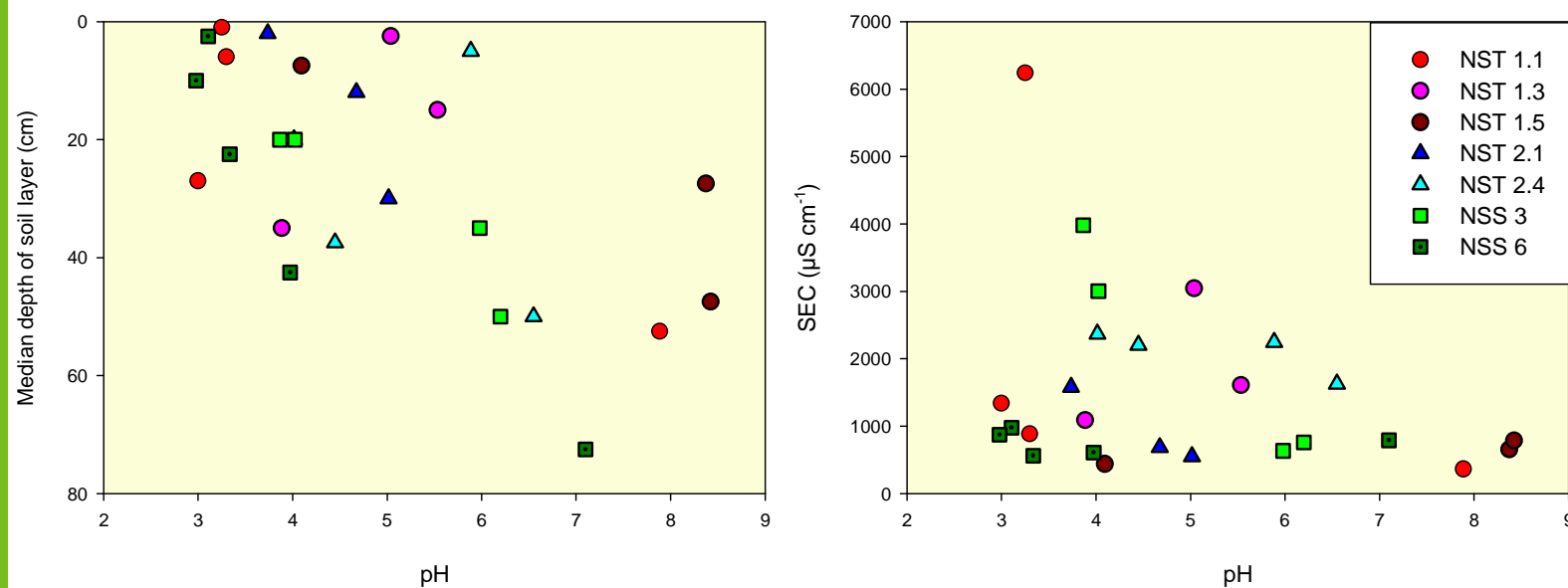
Fe- and Al-hydroxysulfates store acidity and metals which may be released during rewetting: evaporation
fractionates acidity



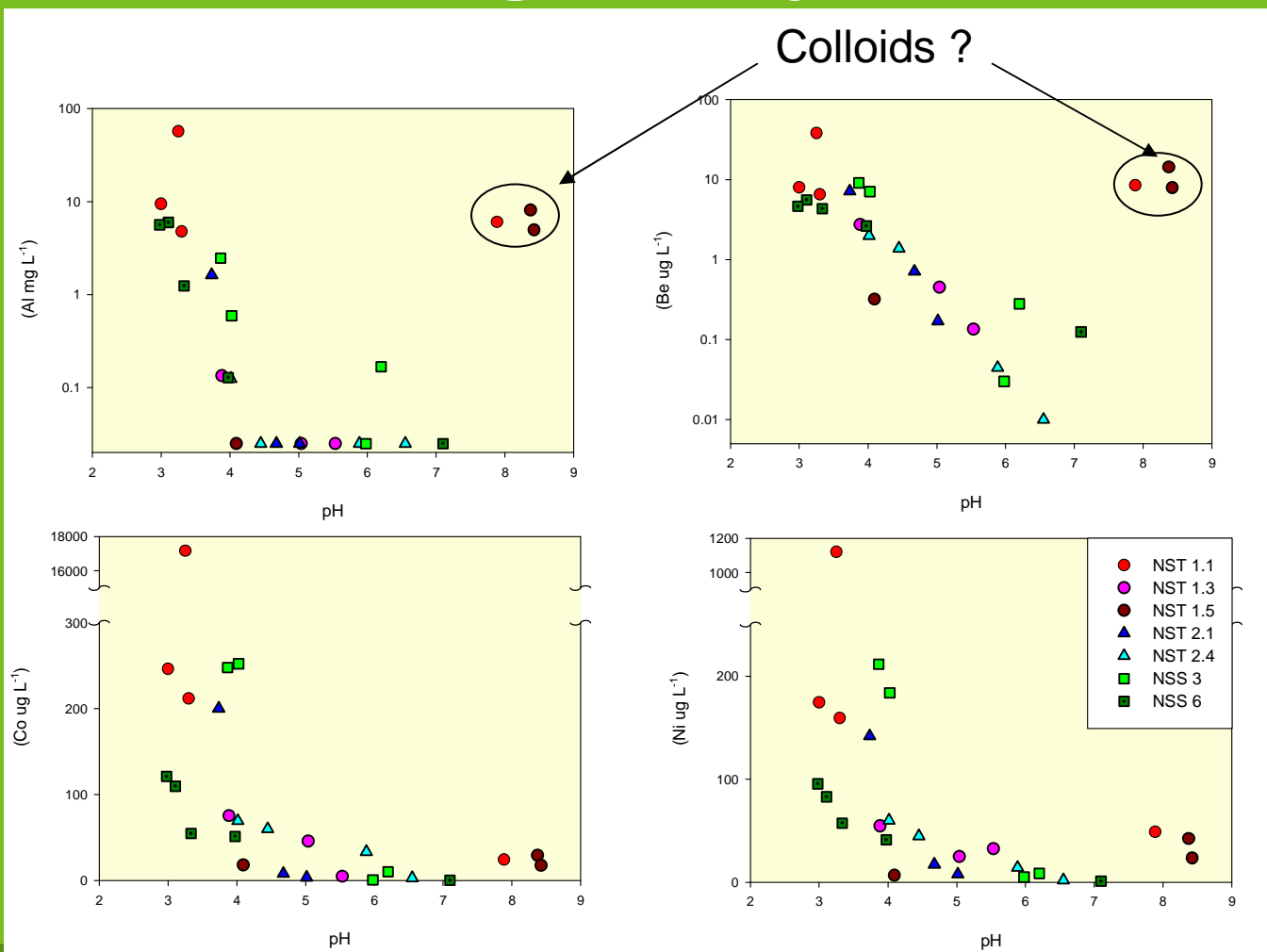
$$\text{Net Acidity} = \text{TAA} + S_{\text{Cr}} + \text{RA} - \text{ANC}/1.5$$

Metal release hazard (24hr tests): pH and SEC

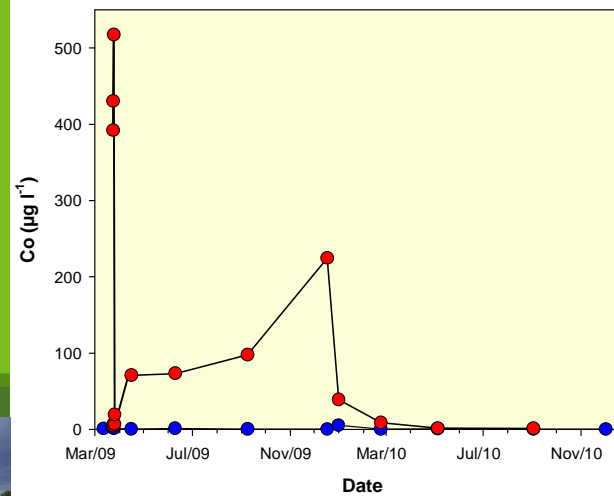
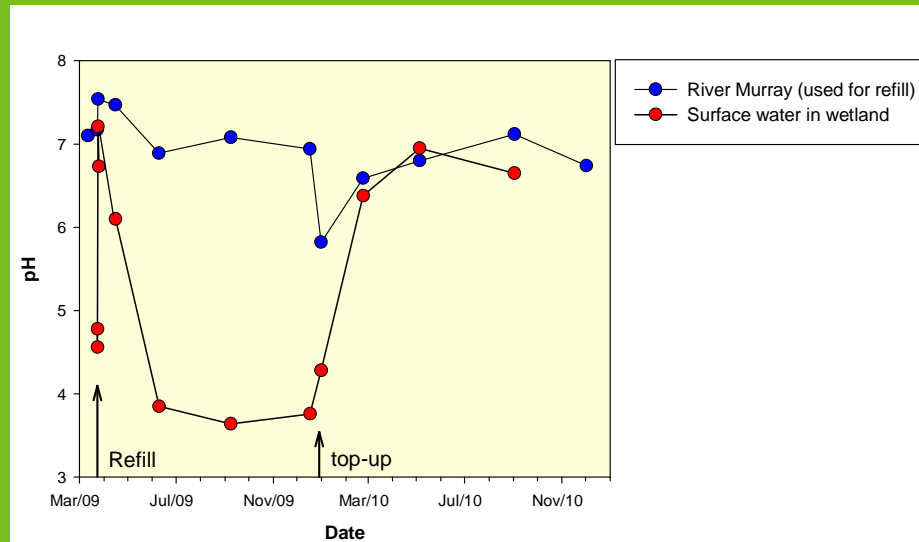
Laboratory water extractions:



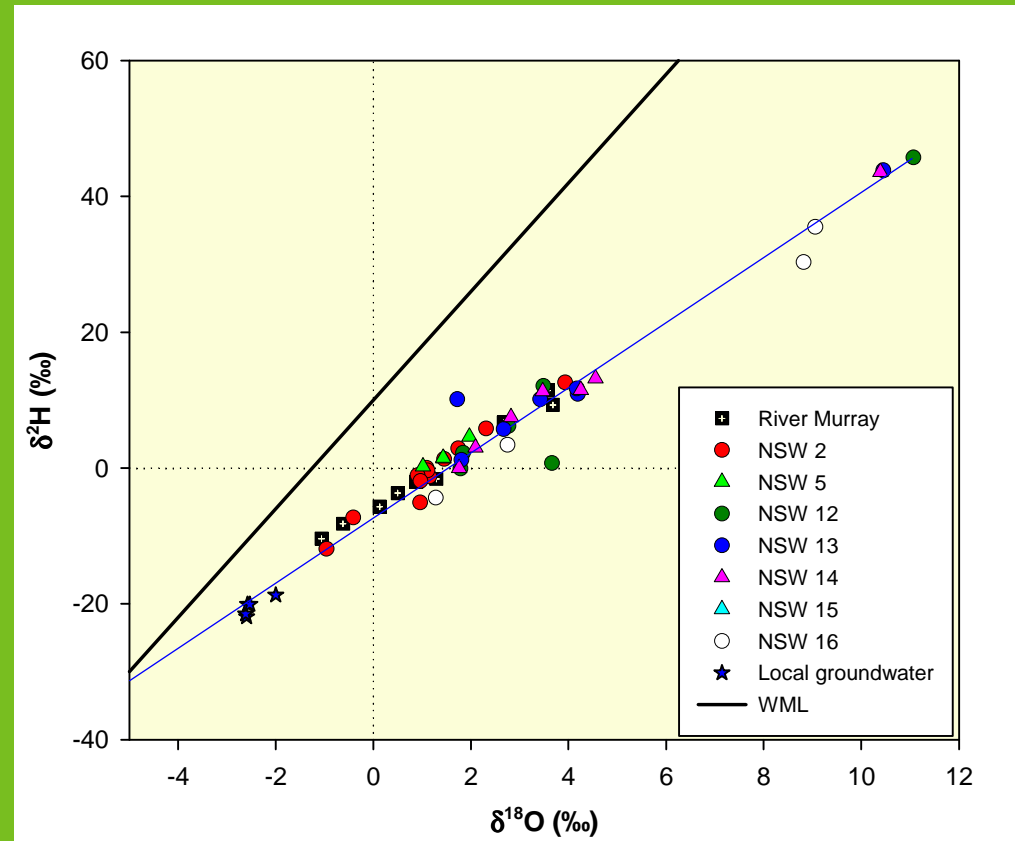
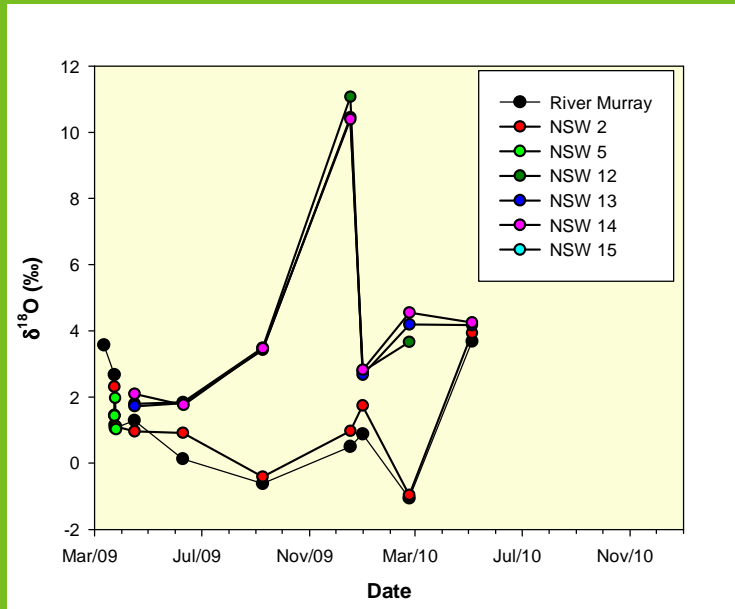
Metal release: original dry soils



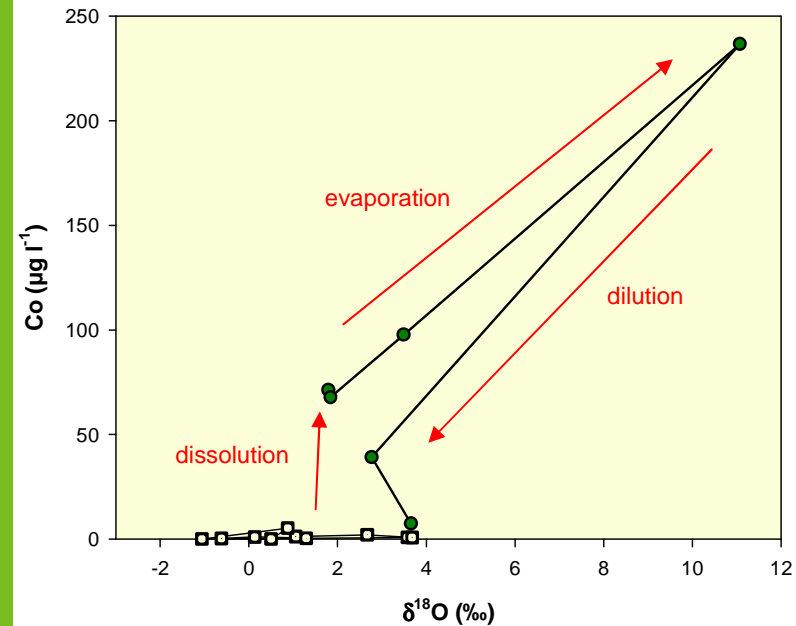
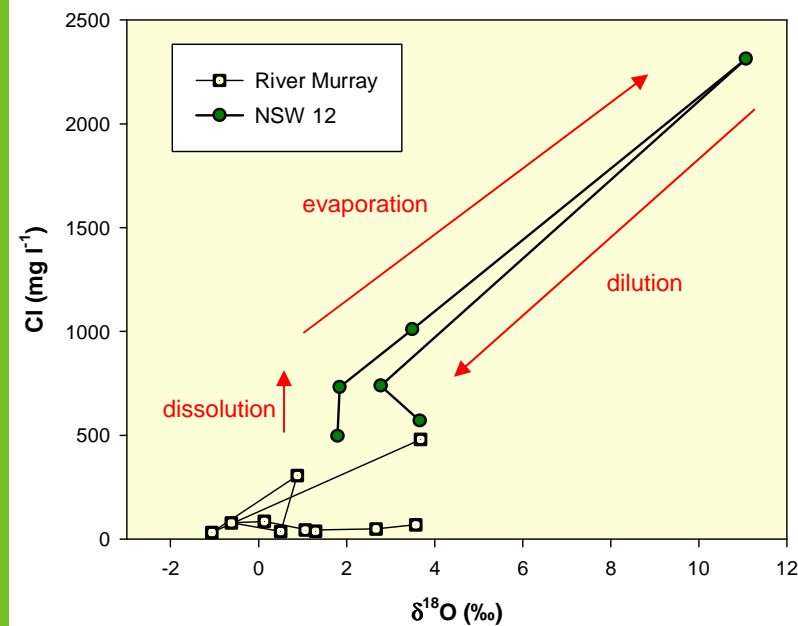
Surface water: pH and metal mobilisation



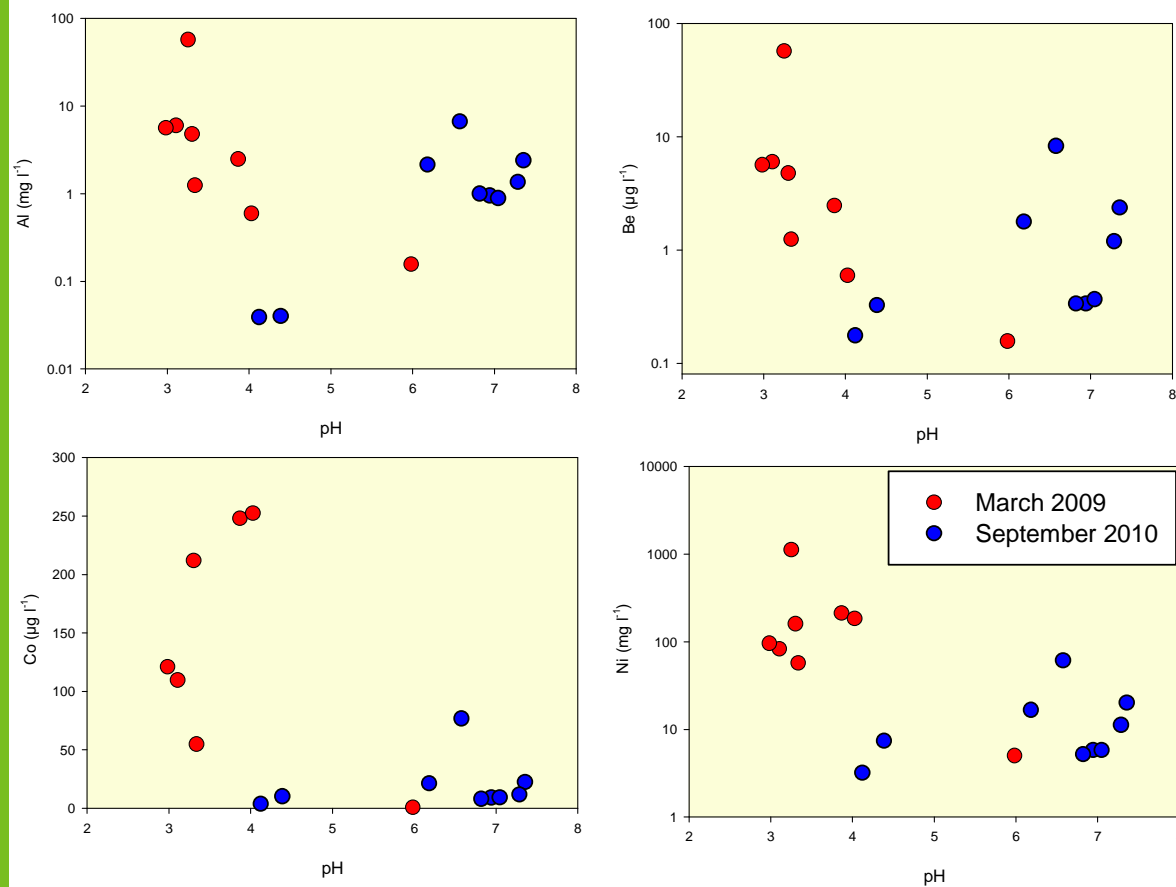
Evaporation important ?



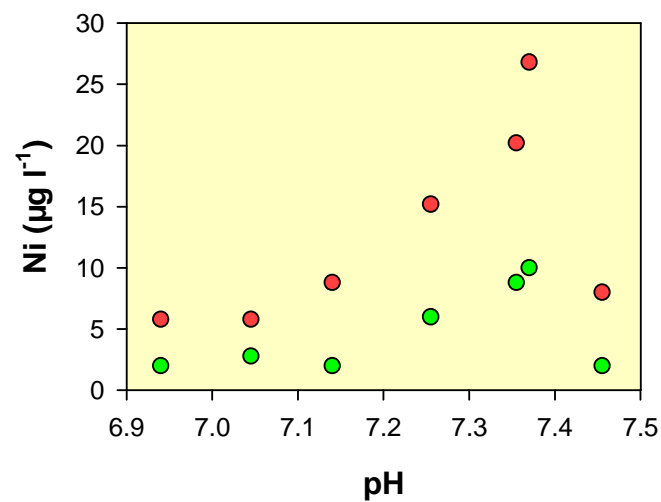
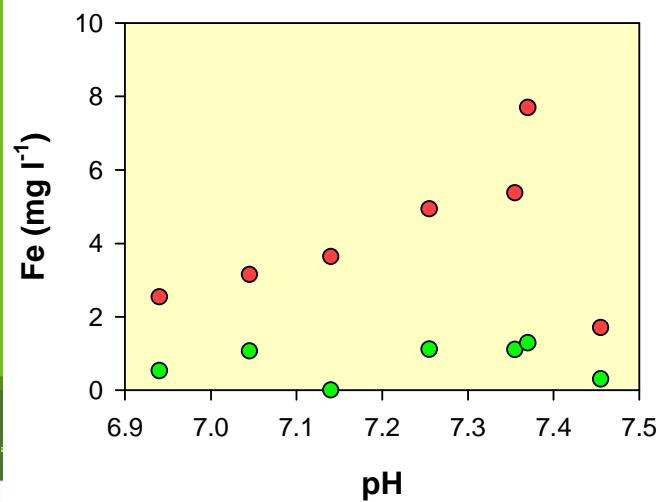
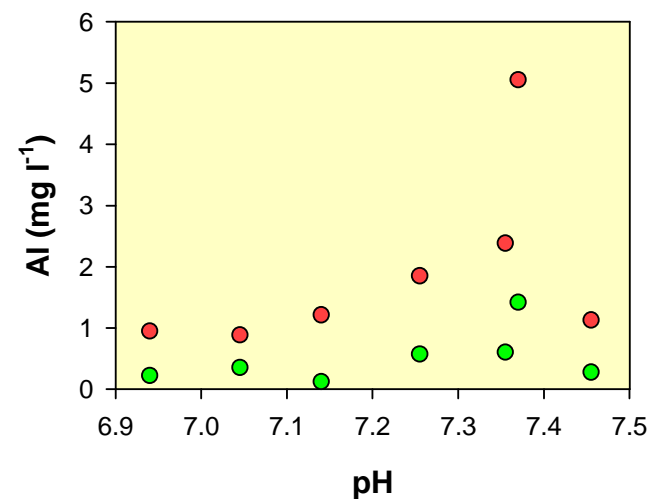
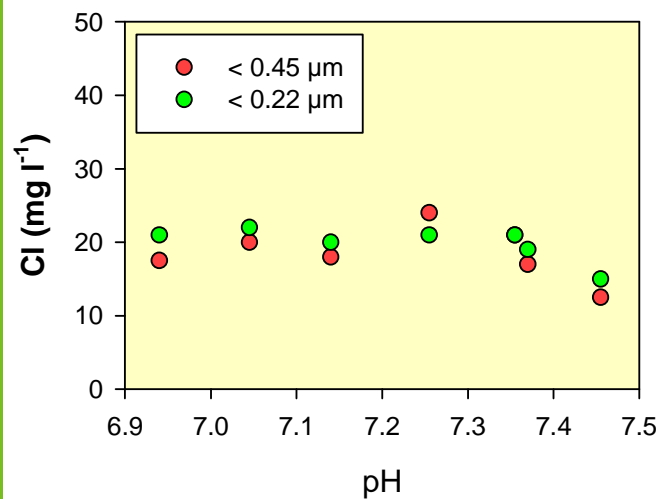
Evaporative control on increasing solute concentrations: otherwise behaved conservatively at low pH



Metal release after 18 months

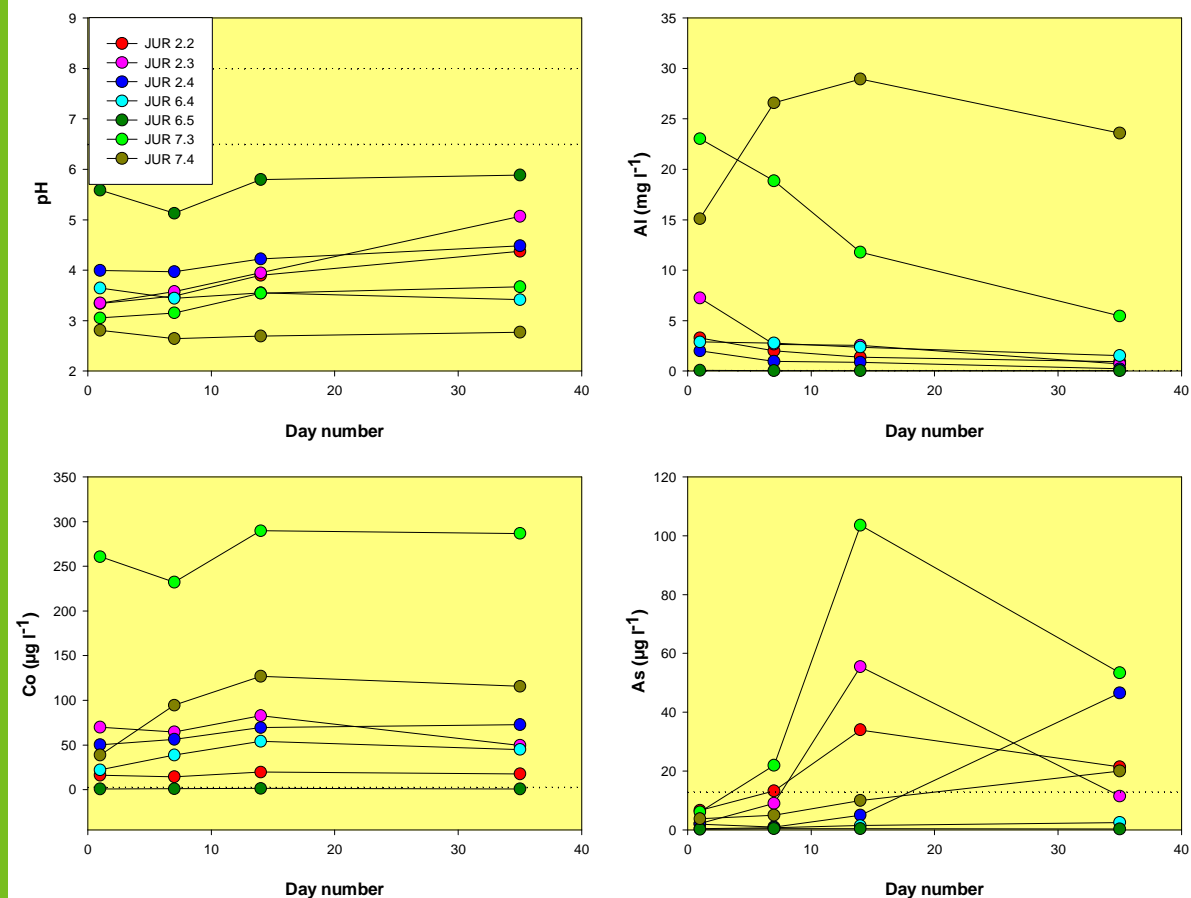


Colloids - yes

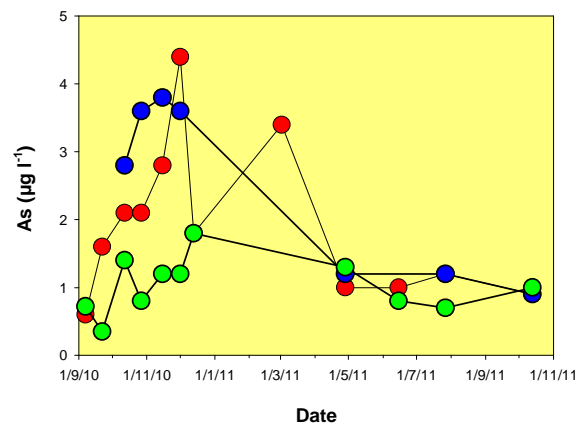
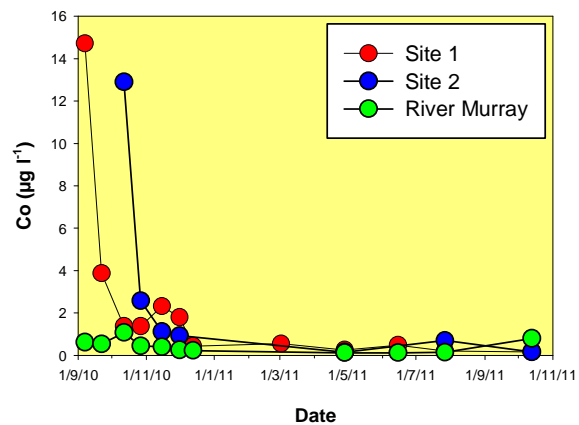
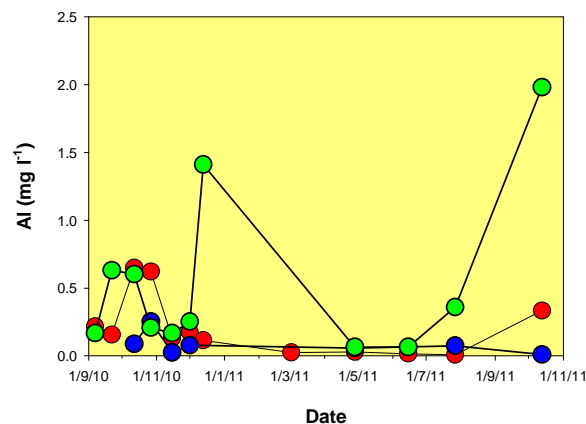
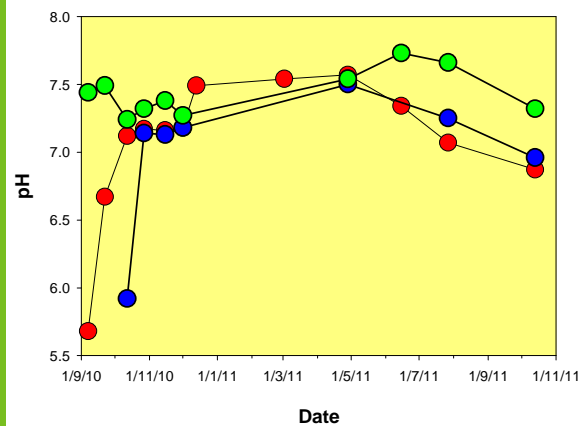


What happened when the drought broke and other wetlands filled ?

Jury Swamp (high hazard): dynamic tests



Jury Swamp filled during high flows



Summary

- Rapid metal release provided good agreement for contaminant concentrations with refilling but provided little information on trends
- Strong pH control on metal/metalloid mobility
- Dominant control on increase in metals/metalloids was evaporation – hydrological dependence
- End of drought prolonged high flows minimised impacts on surface waters – dilution-downward head flux
- Relevance to ecotoxicity – much better need to understand the form of contaminants – colloids very important in inland ASS systems following rewetting

