

# WesternWater Centre

## RESEARCH THEME

- **Groundwater**
  - >\$20M in external funding
  - Current HQP: 25 graduate students & PDFs
  - 5 state-of-the-art laboratories

# 2. Groundwater

## FOCUS

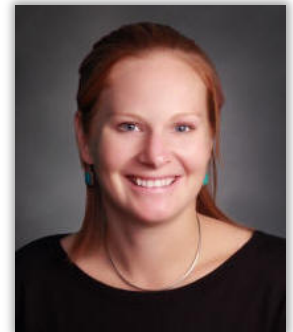
- Fate and transport of contaminants
- Novel site characterization techniques
- Innovative remediation technologies
- Waste reduction/conversion to energy

## OVERVIEW

- 25 postdocs and graduate students
- >\$20M in external funding
- 15+ industrial partners
- 25+ international academic collaborators
- 5 state-of-the-art laboratories
- Advanced computer modelling capabilities
- Field equipment for characterization/monitoring



Jason Gerhard



Clare Robinson



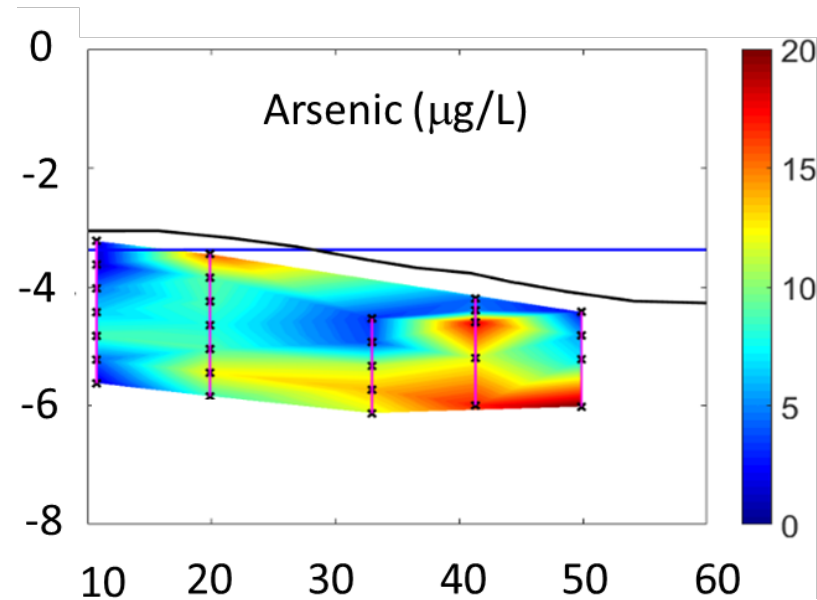
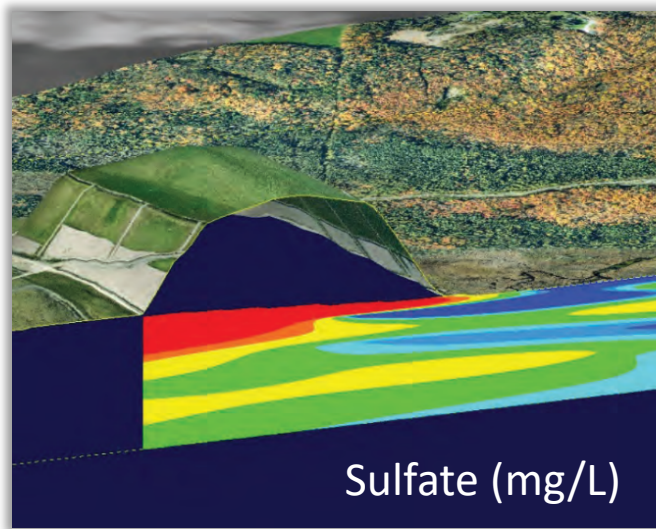
Chris Power

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## Fate and Transport of Contaminants

### FIELD ANALYSIS: GROUNDWATER, SOIL, SURFACE WATER

- Metals
- Emerging contaminants
- NAPLs
- Nutrients

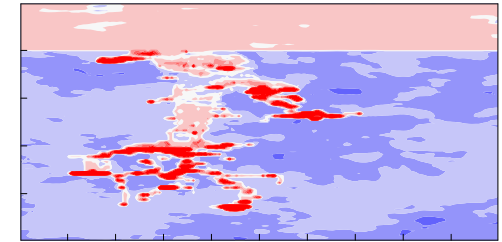
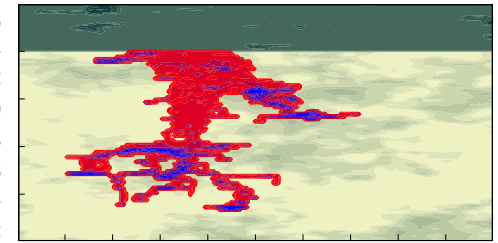


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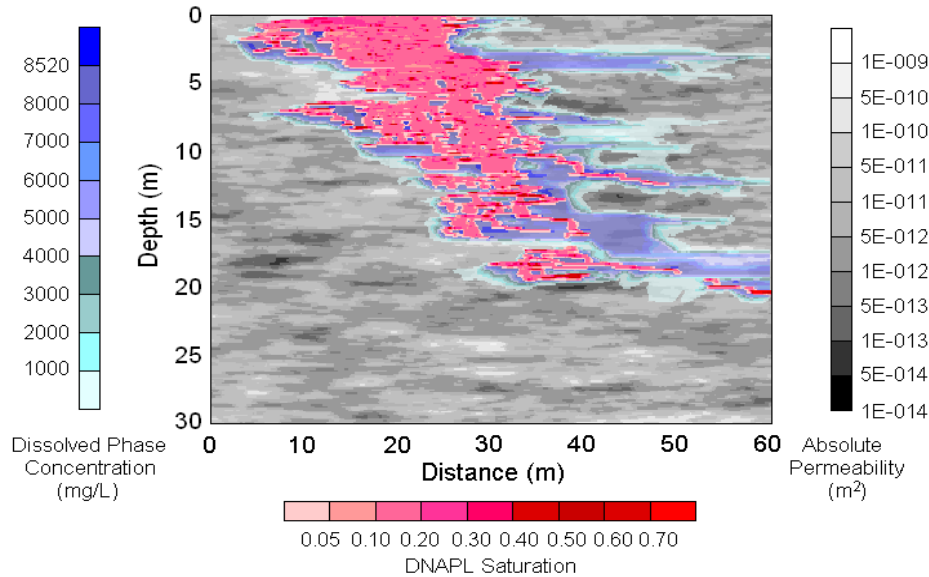
## Fate and Transport of Contaminants

### ADVANCED NUMERICAL MODELING CAPABILITIES

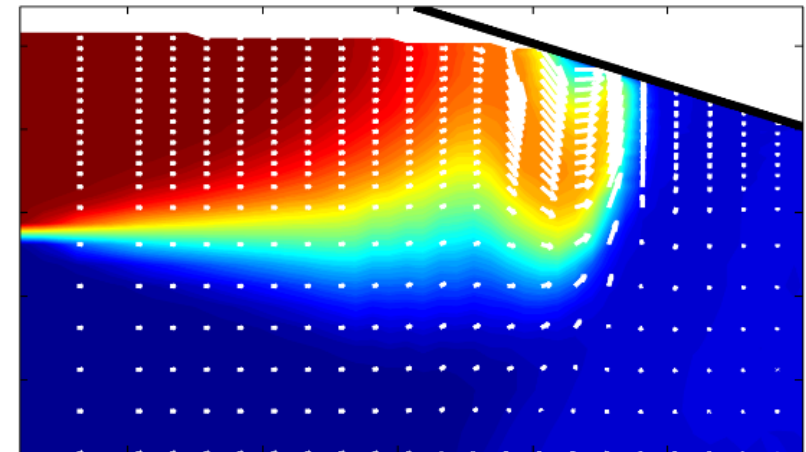
#### Coupled Hydro-Electric



#### Multi-phase flow



#### Reactive transport



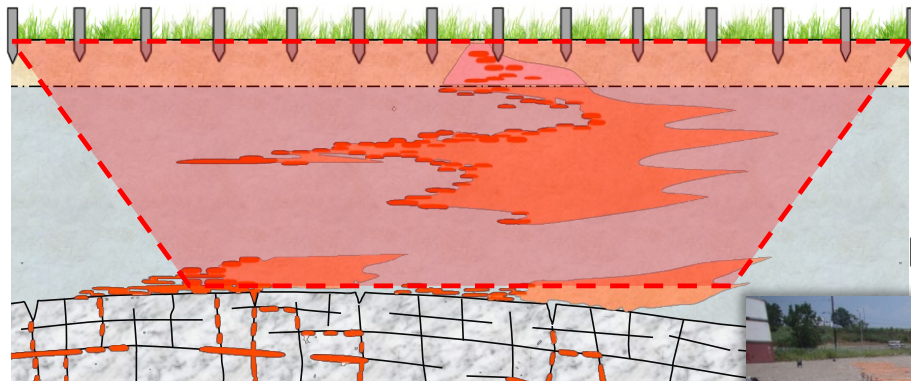
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## Novel Site Characterization Techniques

### GEOPHYSICAL TECHNIQUES

- Electrical resistivity tomography
- Electromagnetic induction
- Induced polarization; ground penetrating radar

Ground penetrating radar



Electrical



Electromagnetics



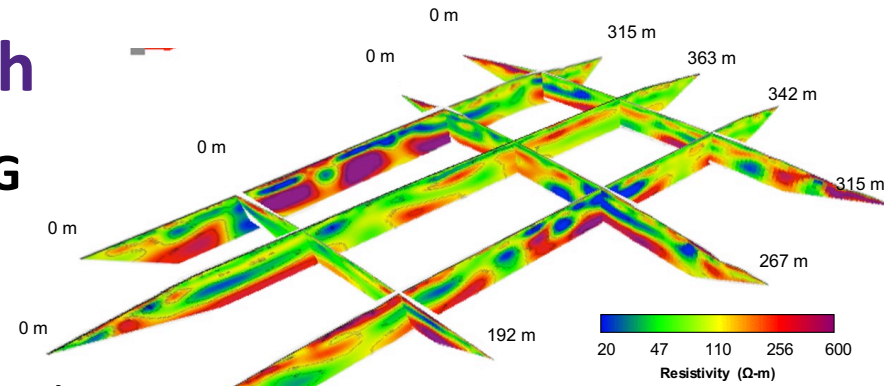
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## Novel Site Characterization Tech

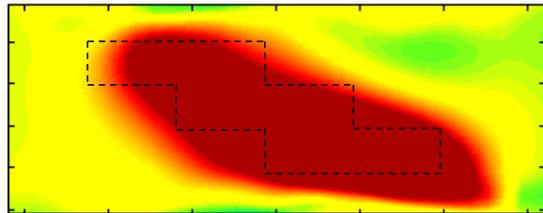
### APPLICATIONS OF GEOELECTRICAL IMAGING

- Monitoring of NAPL migration
- Site remediation monitoring
- Mine waste: composition and cover integrity

### Mine Waste Composition



### NAPL migration



### NAPL Remediation



### Waste Cover Defects



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## Novel Remediation Technologies

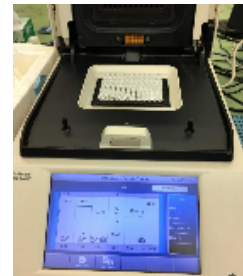
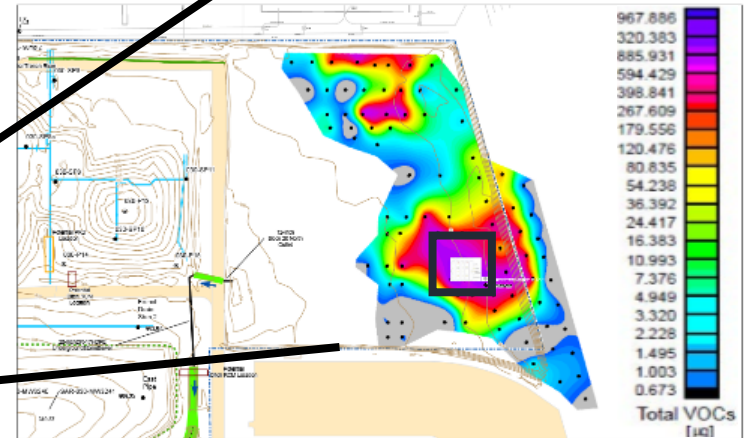
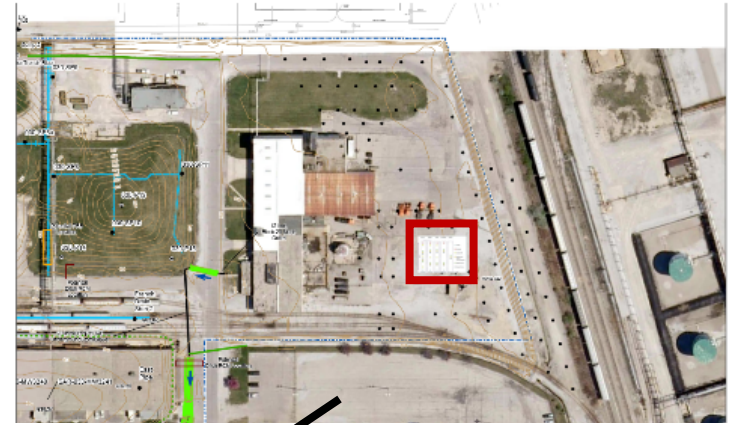
- Bioremediation
- Dual-phase recovery
- *In situ* chemical oxidation
- Electrokinetics
- Nanoparticles
- *In situ* thermal
- Smouldering destruction (STAR)

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## Novel Remediation Technologies

### EXAMPLE: FIELD TRIAL OF ELECTROKINETICS TO ACHIEVE BIOREMEDIATION IN CLAY

- Chlorinated solvent contamination in clay
- EK to deliver lactate to stimulate bioremediation
- Extensive analysis of soil and gw including qPCR and metagenomic sequencing



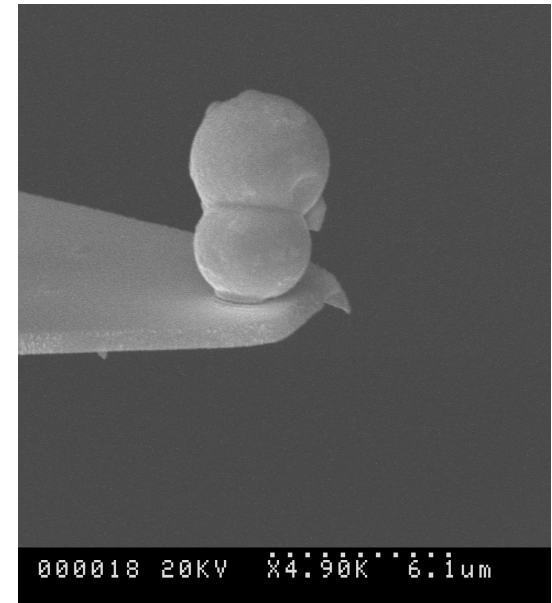


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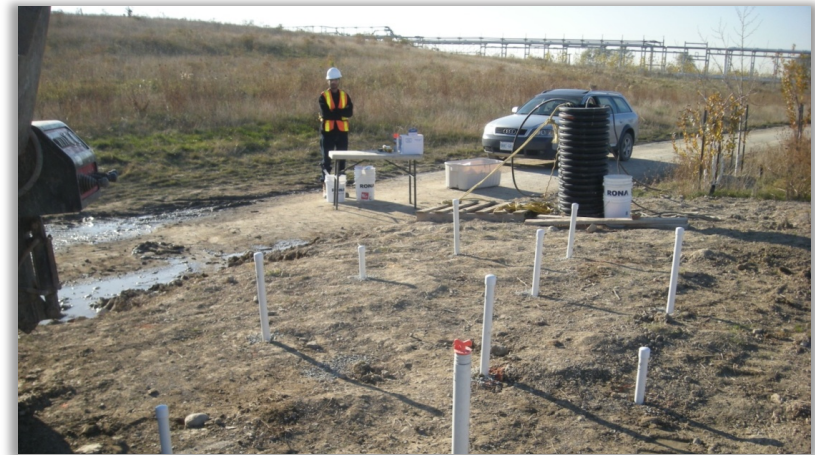
## EXAMPLE: NANOPARTICLE TECHNOLOGY

- Several successful field trials
- Destruction of groundwater pollutants in short- and long-term

*Iron Nanoparticle*



←50 nm→



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## Novel Remediation Technologies

### EXAMPLE: SMOULDERING DESTRUCTION (STAR) OF CONTAMINATED SOIL

- Novel site treatment
- Highly destructive for organic pollutants
- Developed from concept to full scale *in situ* and *ex situ* applications



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## Waste Reduction/Conversion to Energy

### EXAMPLE: STAR TREATMENT OF ORGANIC WASTES

- Destruction of organic wastes using minimal energy
- WWTP biosolids, pulp and paper waste, faeces, agricultural waste
- Recover excess energy, recover metals and nutrients, treat emissions

