Integrated Characterization Approach for the 300-FF-5 and IFC Experimental Sites

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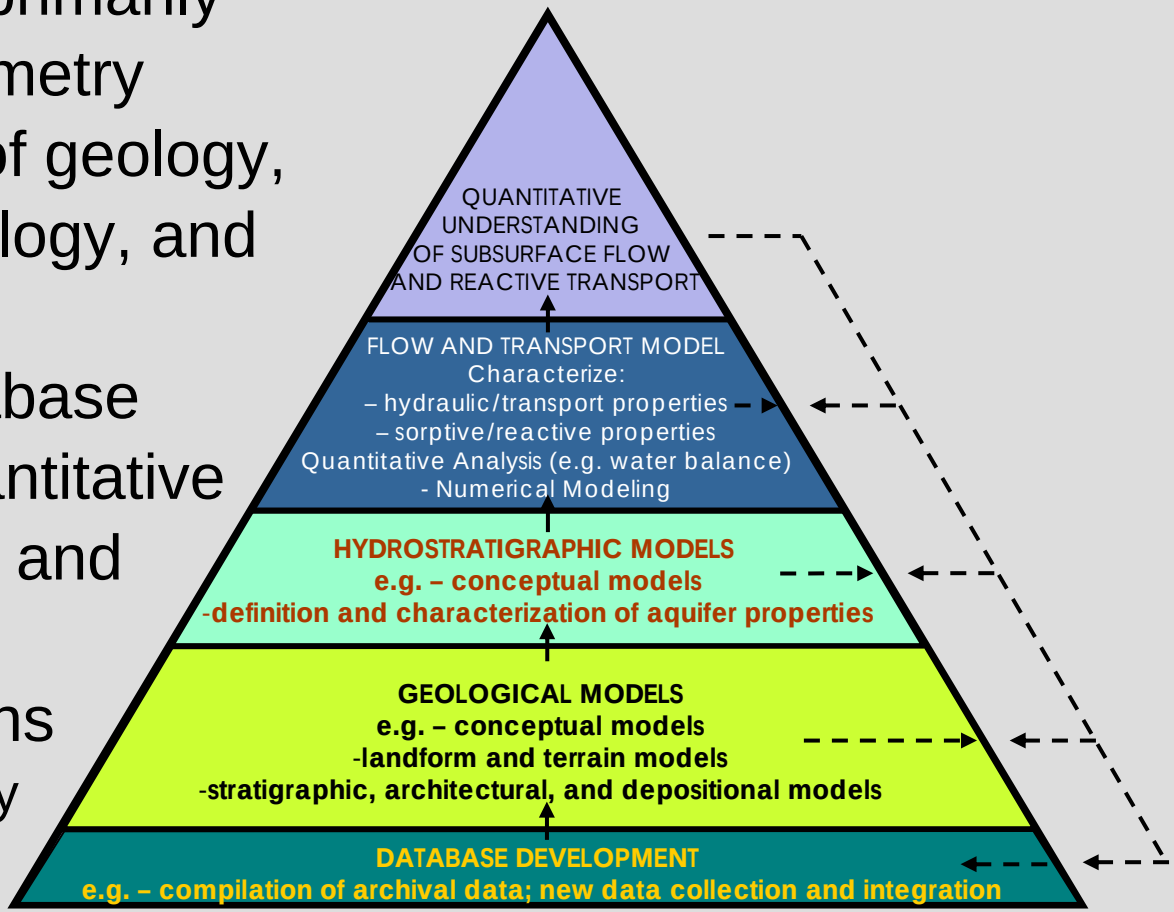
Rationale

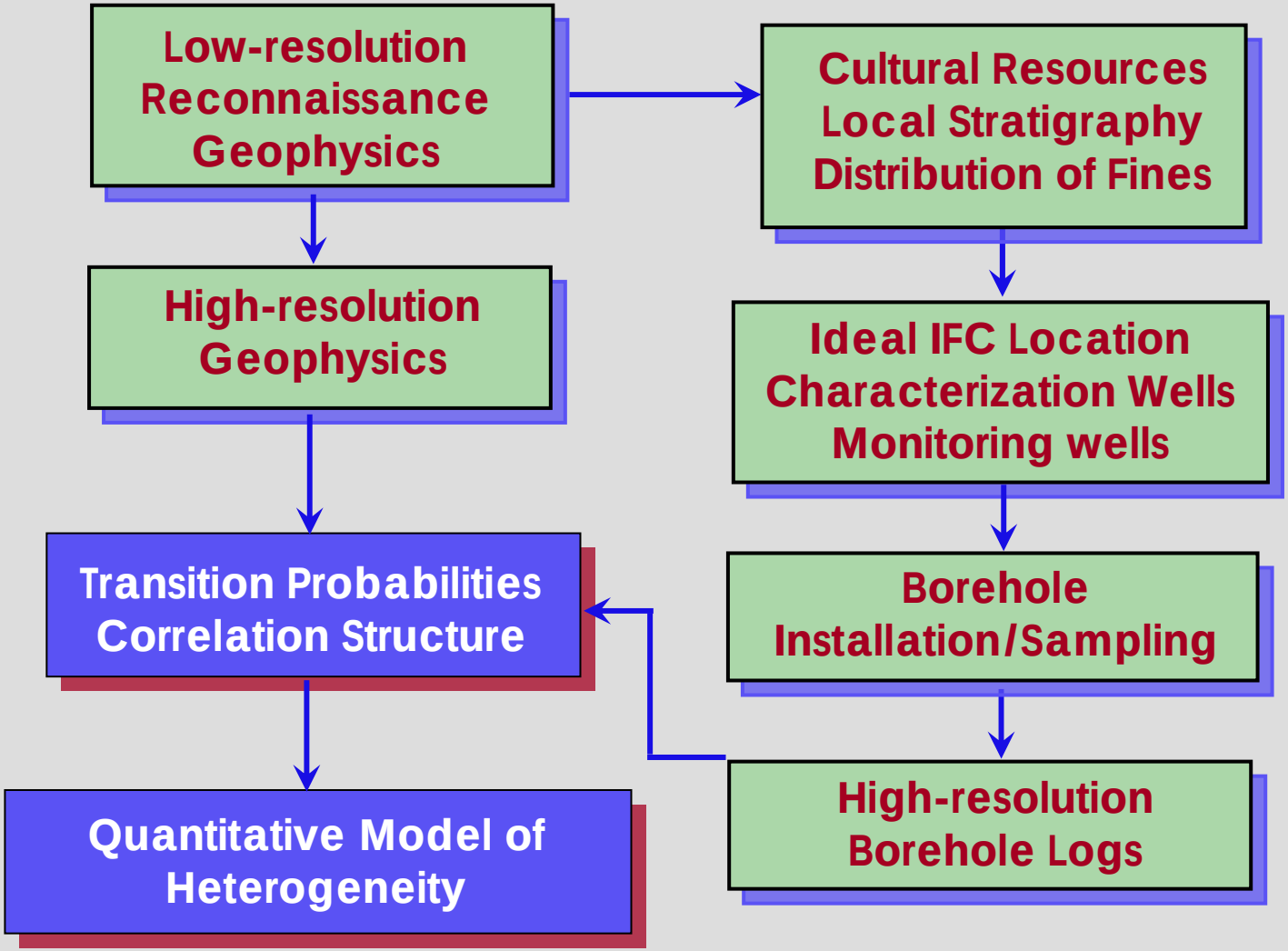
- Previous conceptual models somewhat simplified
  - Boundary conditions
  - Hydrostratigraphy
  - Heterogeneity
- Current ERSP project aimed at developing tools and protocols to
  - Integrate site characterization
  - Quantify heterogeneity to reflect geologic variability
- Directly linked to IFC
  - Site location
  - Characterization
  - Conceptual model formulation
  - Model calibration

Integrated Approach to Characterization

- Sediment properties primarily controlled by granulometry
- Combines elements of geology, hydrology, sedimentology, and geophysics
- Progresses from database development to a quantitative understanding of flow and transport
- Successful applications
  - Regional hydrogeology
  - Petroleum industry

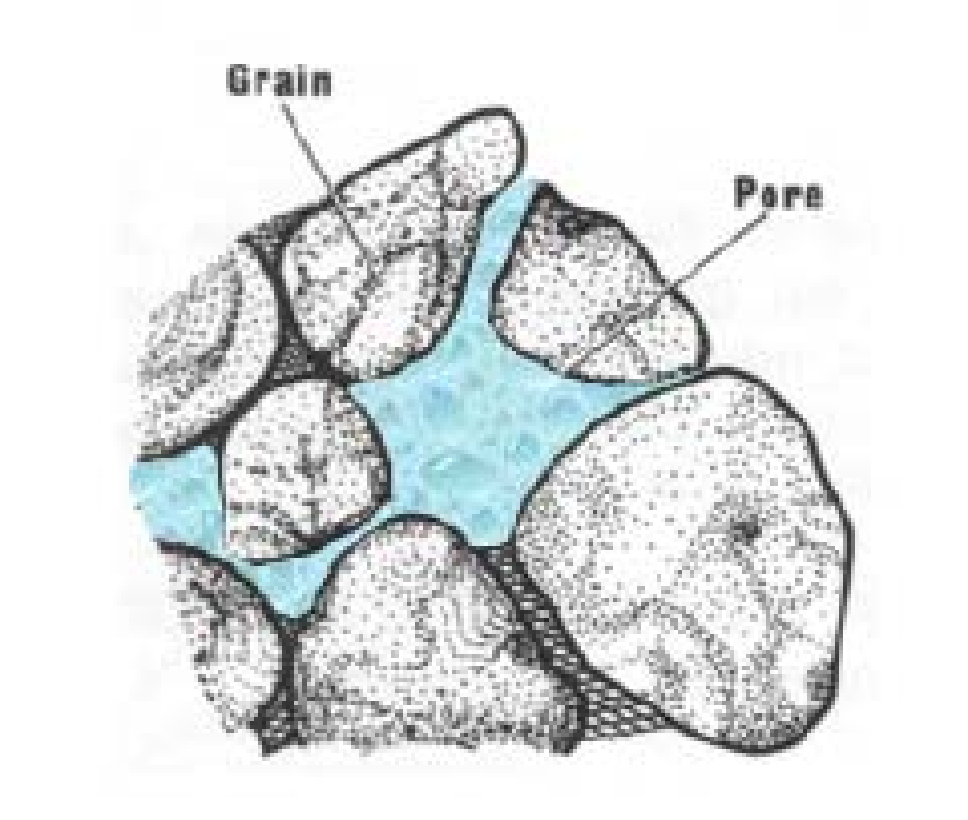


Hydrogeophysical Workflow



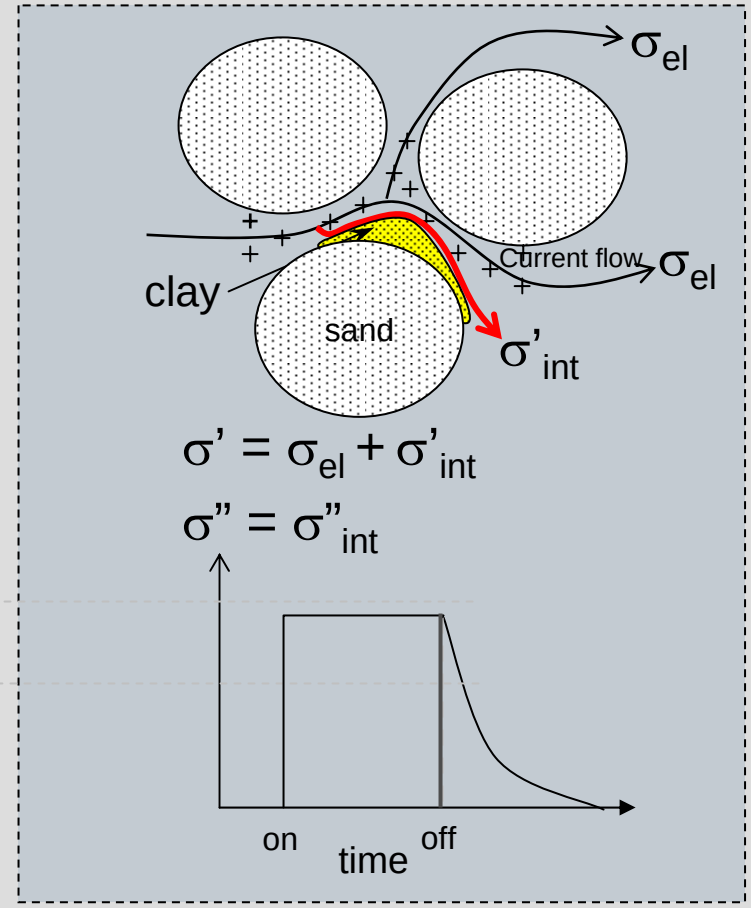
Geoelectric Methods- Resistivity

- Depends on
  - Specific conductance (soil type)
  - Water content
  - Pore water conductance
  - Temperature
- Characterize subsurface hydrogeology
  - Depth to bedrock
  - Depth to groundwater
  - Map stratigraphy
  - Map clay aquitards
  - Map salt-water intrusion
  - Map vertical extent of contam
  - Estimate landfill thickness



Geoelectric Methods- Induced Polarization

- Depends on
  - Soil type
  - Pore size distribution
  - Pore water conductance
- Applications
  - Grain size
  - Hydraulic characteristics
  - Lithologic composition
  - Inorganic vs. organic contaminants
  - Metals

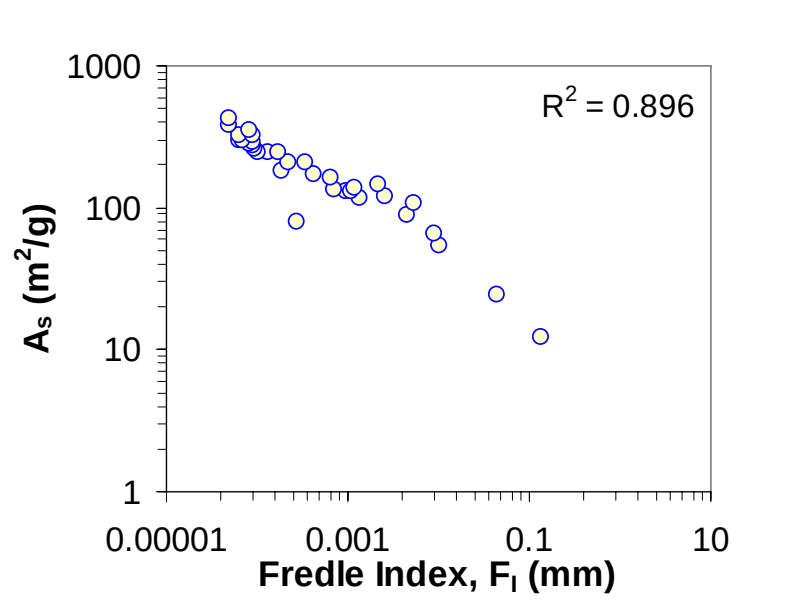


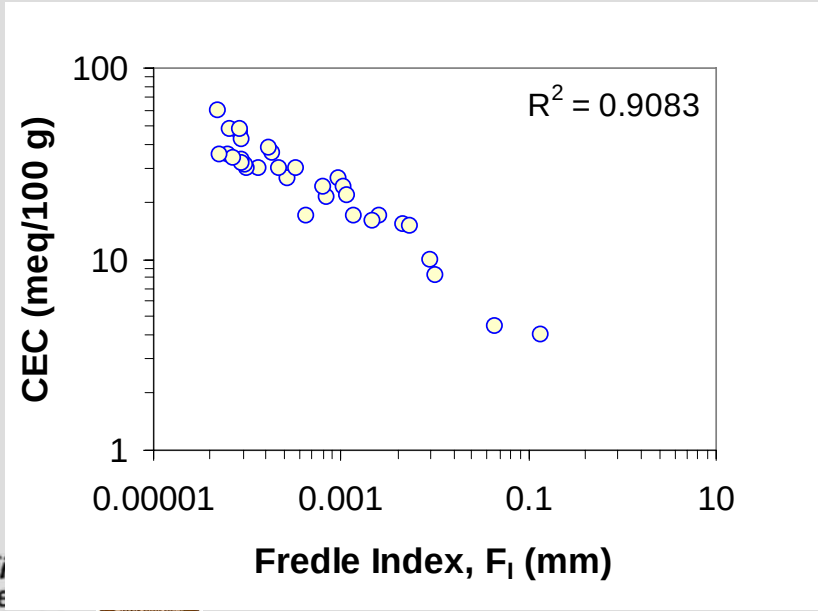
Field Application

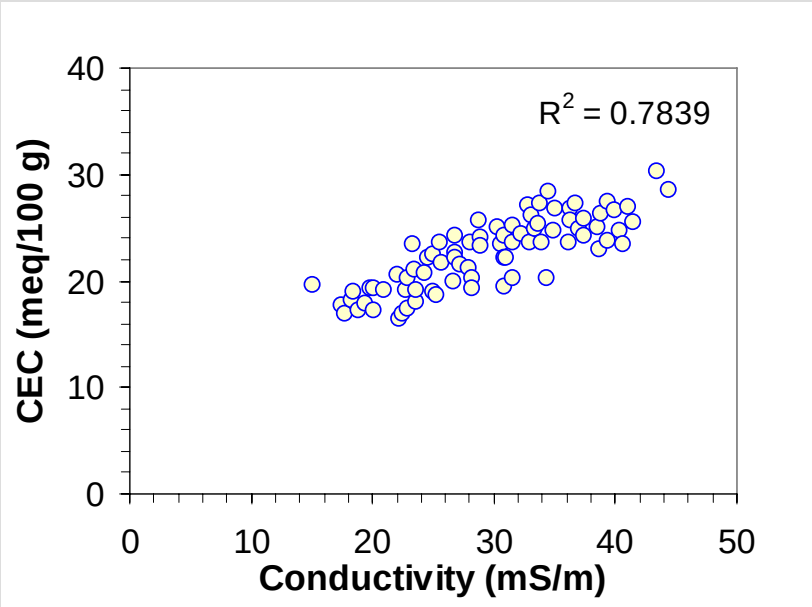
- 50 x 50 m Grid (GPS)
- Flagged at 5 x 5 m grid
- 300-m long lines
  - Magnetometer
  - Electromagnetic Induction
  - Electrical Resistivity
  - Induced Polarization
  - Ground Penetrating Radar
  - Self Potential
- Seismic
  - Planned for the winter 2007

Sediment Properties Primarily Controlled by Granulometry

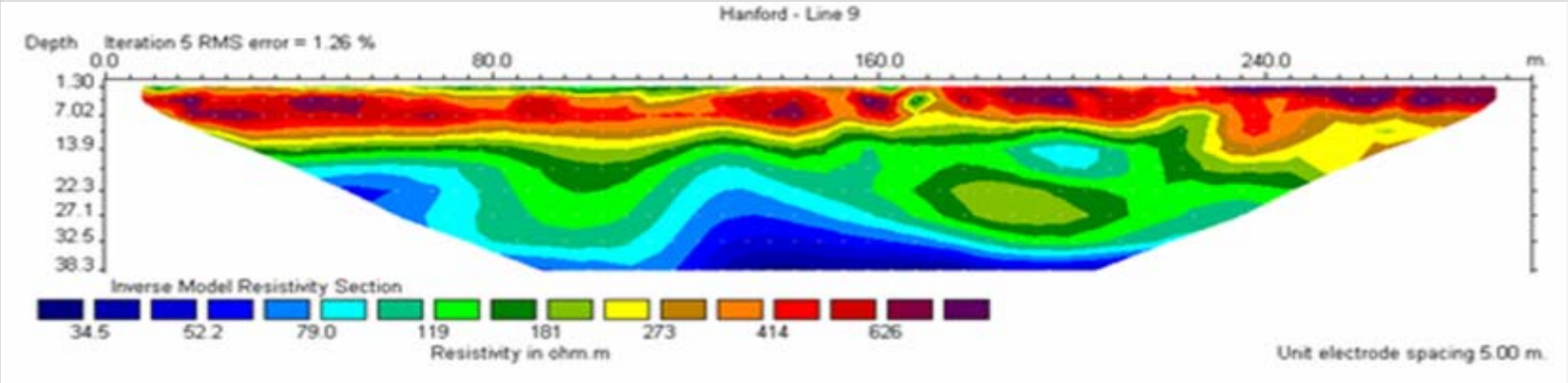
- Increasing %fines
  - Increased surface area
  - Increased exchange capacity
  - Increased chargeability
  - Increased conductivity

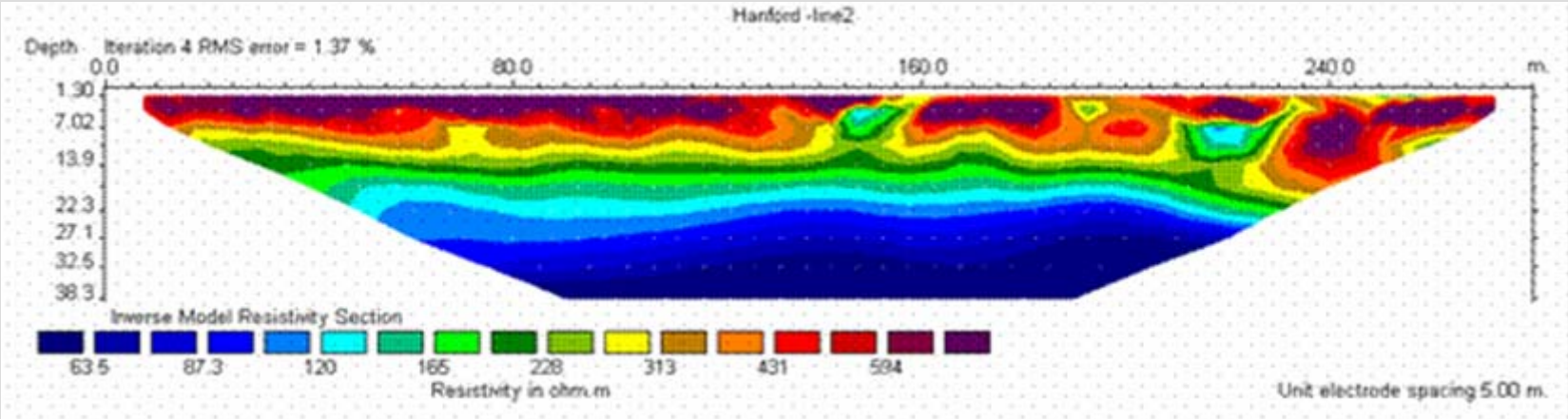




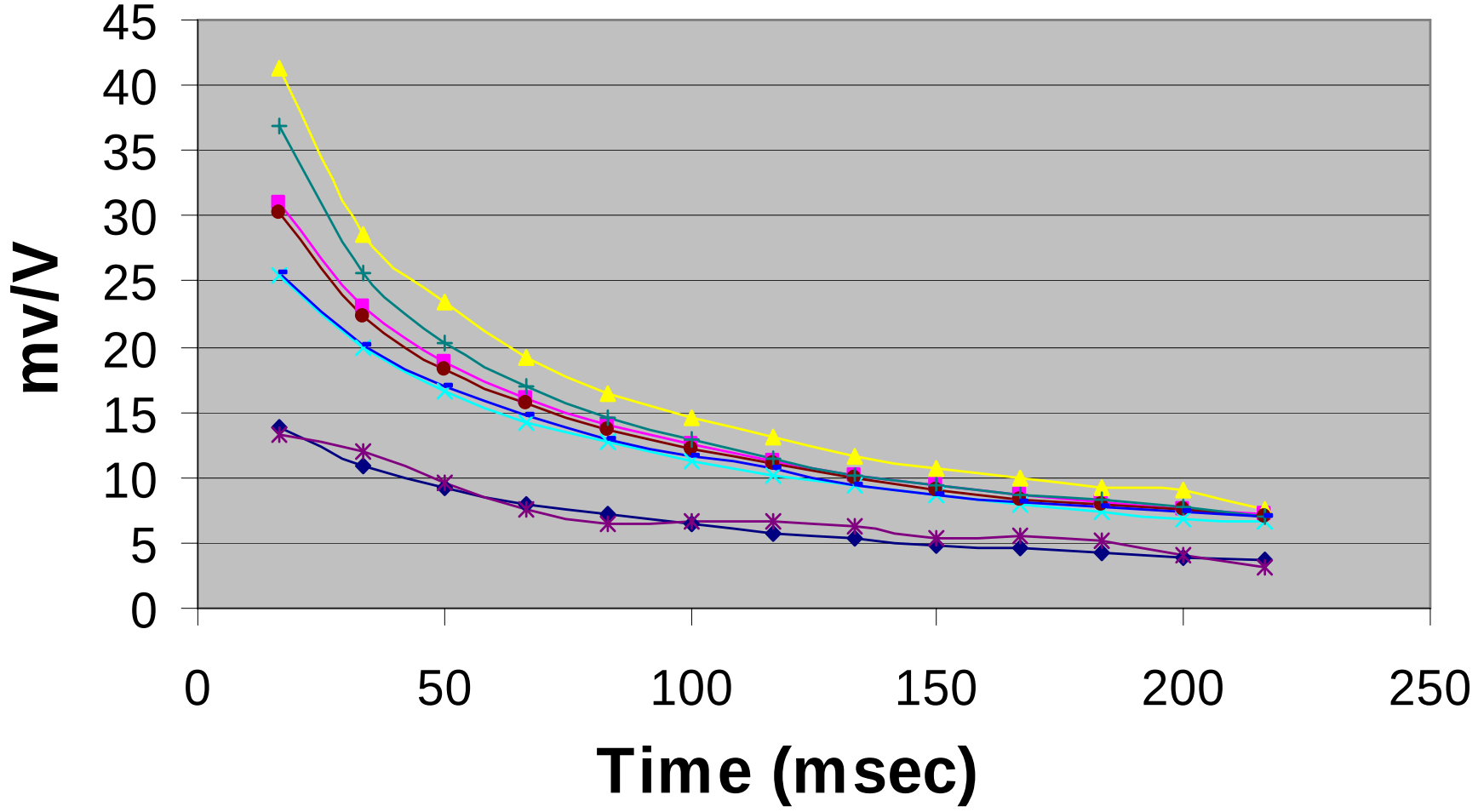


IFC Site Location
"Uniform Hanford-Ringold Contact"



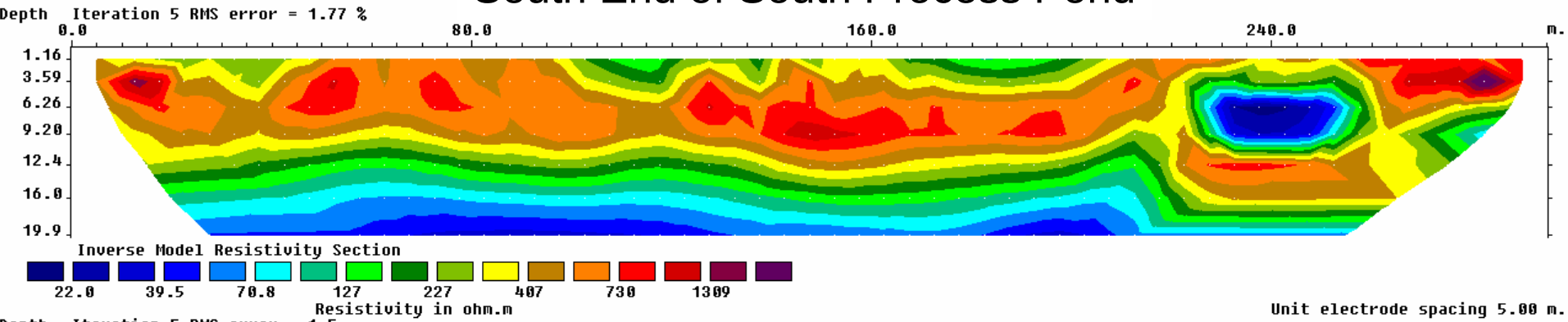


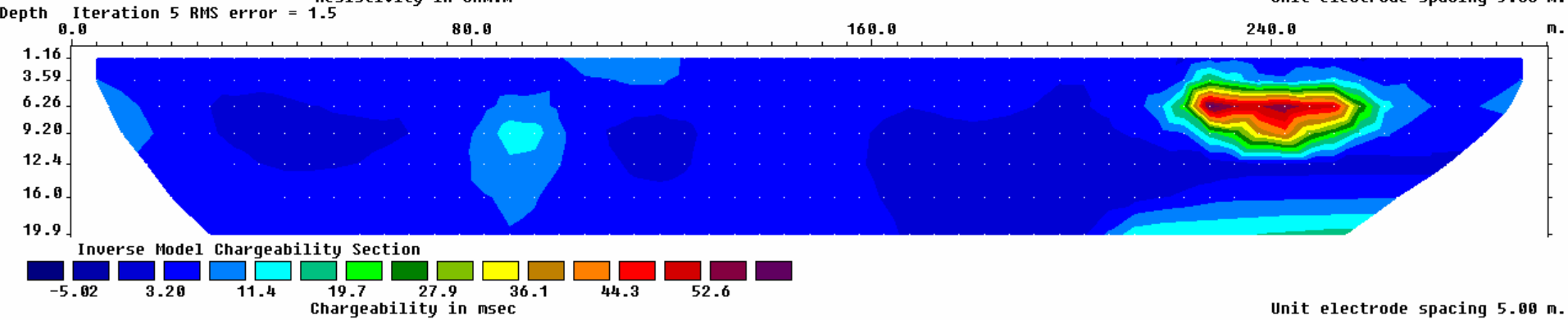
IFC Site Location
"High Fines Content"



Conceptual Model Formulation
Additional Vadose Zone Sources???

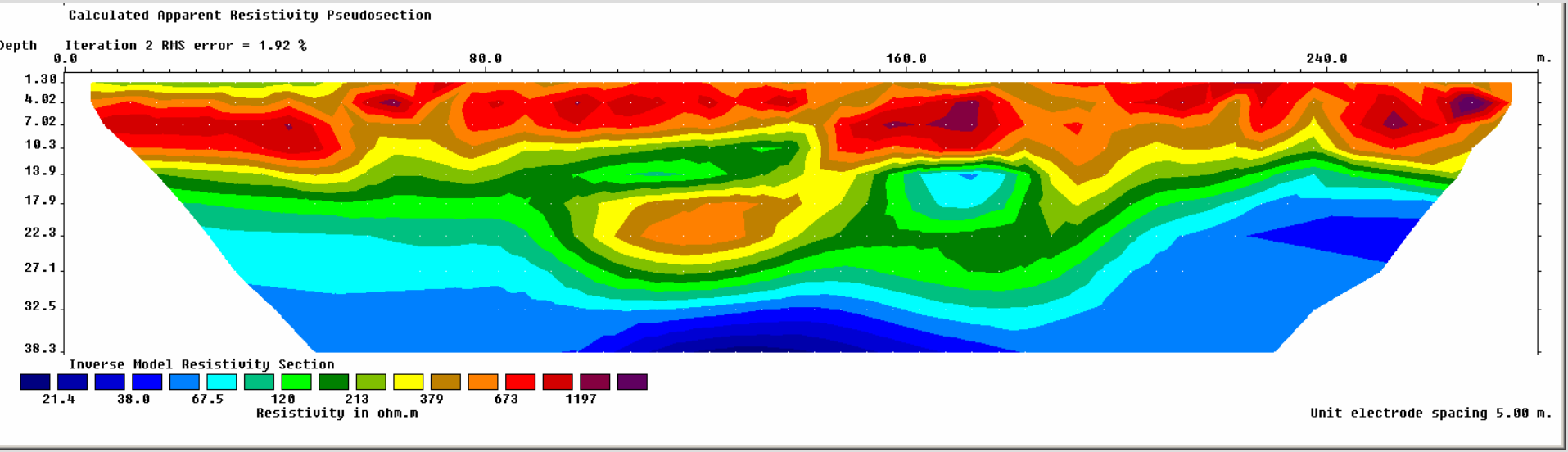
South End of South Process Pond





Conceptual Model Formulation- Preferential Flow Channels

- Detect changes due to mixing
- Some basic properties:
  - River conductance: 124 μS/cm
  - Groundwater conductance: 484 μS/cm
  - During acquisition period groundwater level fell
  - During acquisition period river gage N of site rose, then fell



Summary

- Hydrogeophysical tools provide a viable method for characterization and monitoring
  - ERT shows significant structures at site
  - High conductivity, high chargeability anomaly west of old SPP could be due to a variety of accumulated materials (e.g. dissolved metal cladding of rejected fuel assemblies, fly ash, strong electrolytes or other processing wastes)
  - Data being applied to optimize site selection for the field tests
- Application to IFC
  - Site location and experimental site design
  - Characterization
  - Monitoring
- Laboratory and Modeling studies
  - translate geophysical responses into physical and chemical attributes
  - Integration with auxiliary data (e.g. well measurements)
  - Verification of data quality
  - Refine conceptual model and estimate field-scale parameters