

Battelle 2023 Bioremediation Symposium

The Reality and Strategies of Conducting PFAS Remedial Investigations in Evolving Uncertainty

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Problem Statement

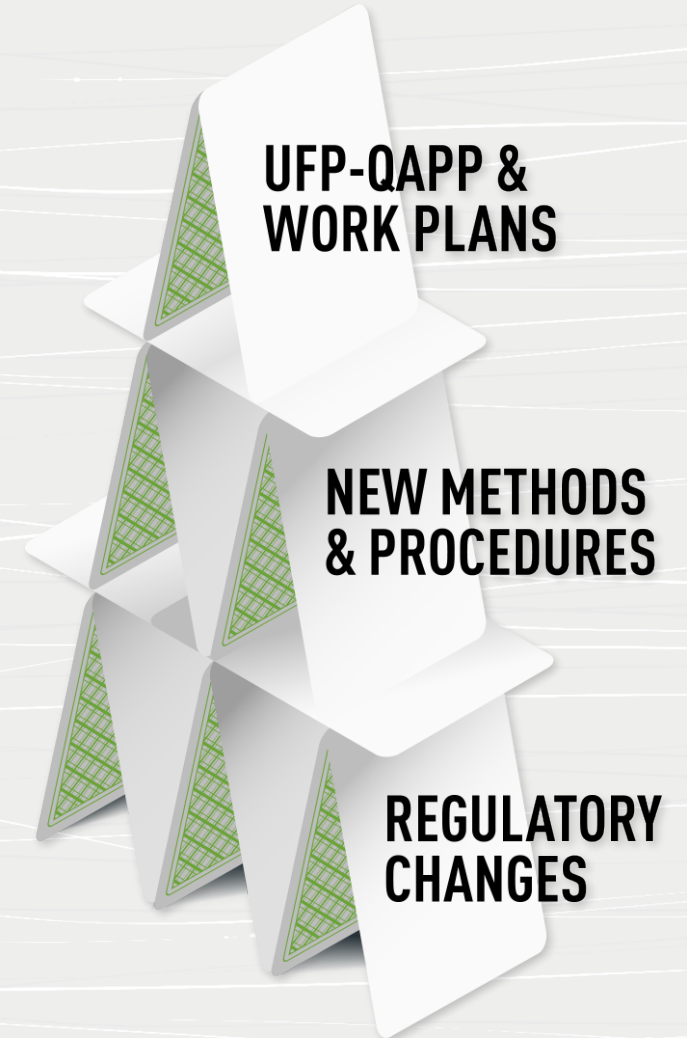
How do you complete work if the....

- *Playing field is changing*
- *Target is changing*
- *Standards are changing*
- *Regulations are changing*
- *Science is changing*
- *Messages to Communities are changing*



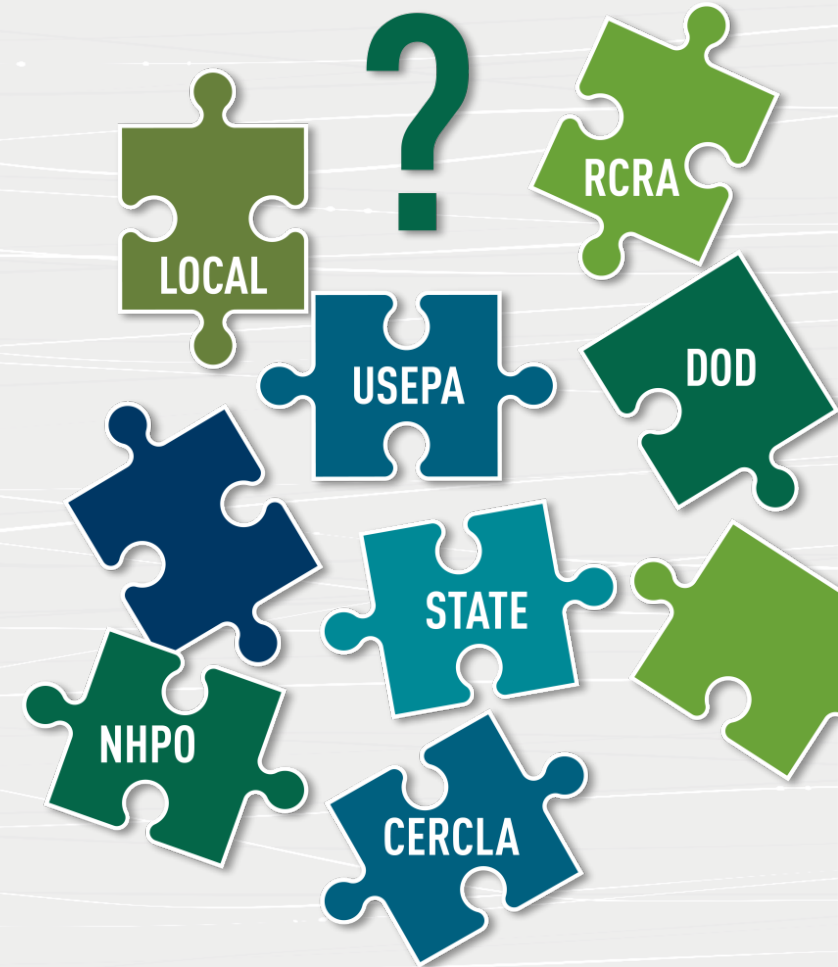
■ Procedural Change and Uncertainty

- *New Regulations – which PFAS constituents?*
- *New Regulations - RSLs, proposed MCLs, Interim LHA*
- *New Regulations – different state/local levels*
- *New analytical method – costs, lab capacities, collection methods, updates to laboratory protocol*
- *New analytical method – data comparability*
- *New UFP-QAPPs & Work Plans*



■ Policy Change and Uncertainty

- *Disharmony in policy between USEPA, DoD, State, and Local Agencies (e.g. CA RWQCB)*
- *Rescinded guidance to AFFF waste disposal policy*
- *USEPA and DoD discord for investigative phases under CERCLA*
- *New USAF guidance on addressing NHPA requirements during investigative phase*
- *USEPA moving forward with steps to designate PFAS constituents as hazardous substances under CERCLA and potentially as hazardous wastes under RCRA*



■ Changing Science and Uncertainty

- *Pervasive presence in environment at regulatory levels*
- *How many PFAS constituents do we have?*
- *Precursor implications during investigation and remediation efforts*
- *New toxicological studies and data – understanding for human health, ecological, food web, etc.*
- *Understanding fate and transport of different constituents in different environments including interaction between media*
- *Remedial technology development – the (multi) million dollar question*



- **Overarching Uncertainty**

- *How do we responsibly communicate results, risks, changes, and uncertainty to our public stakeholders?*



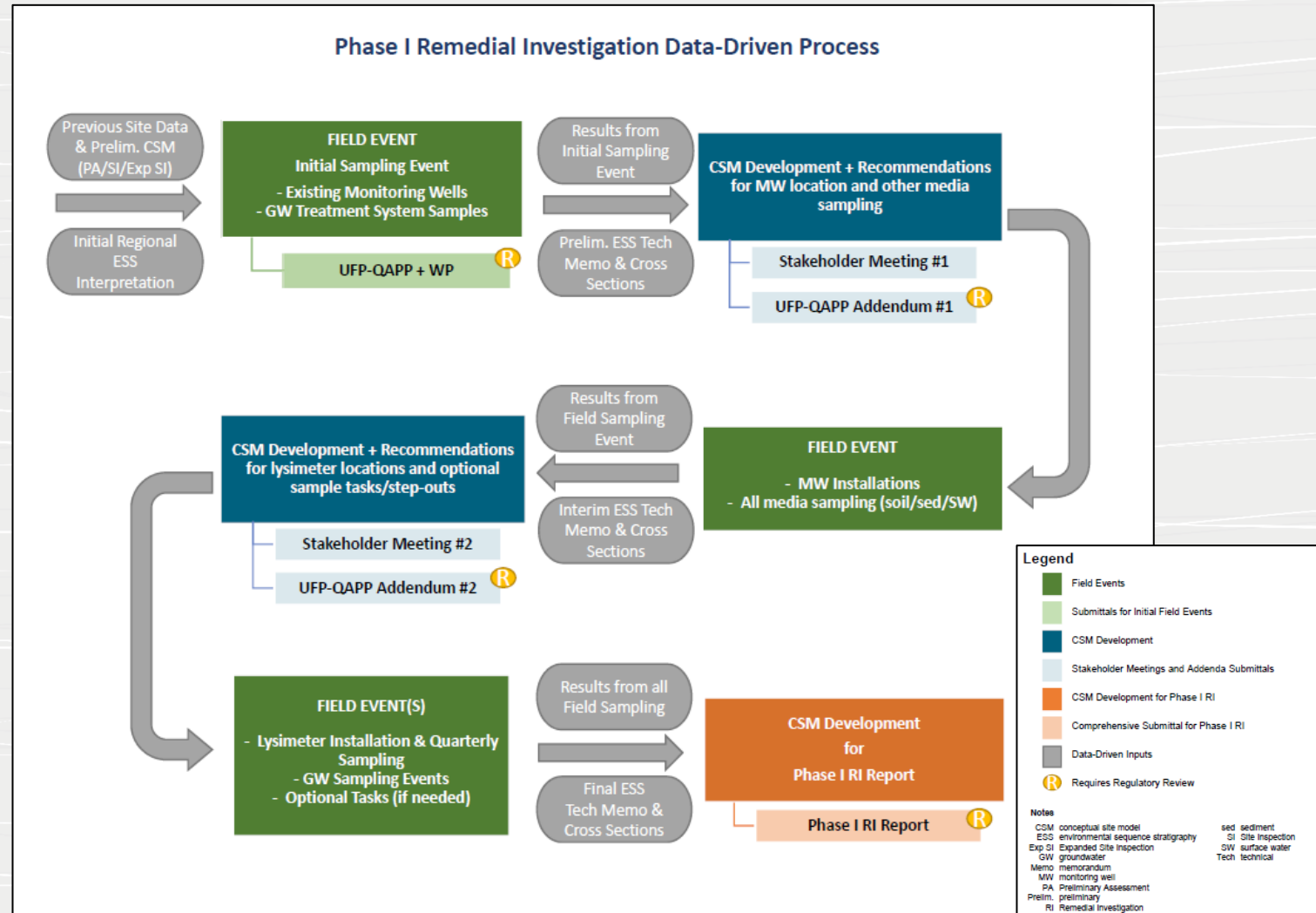
Shared *Lessons Learned* to help you get to work

- *Early establishment of a data-driven process and road map*
- *Develop comprehensive site-wide GIS*
- *Use GIS to support Conceptual Site Model (CSM) development*
- *Use of High Resolution Site Characterization Tools, Environmental Sequence Stratigraphy (ESS), and other Best Practices as project scope permits*
- *Collection of geochemical and geotechnical data to support evaluation and remediation considerations*
- *Communicate early and often*

Lessons Learned

Early establishment of data-driven process

- *Develops phased approach*
- *Allows specific junctures to address procedural and policy changes*
- *Maintains focus on using data to make decisions*
- *Promotes communication and opportunities for consensus*



Develop Comprehensive Site-wide GIS

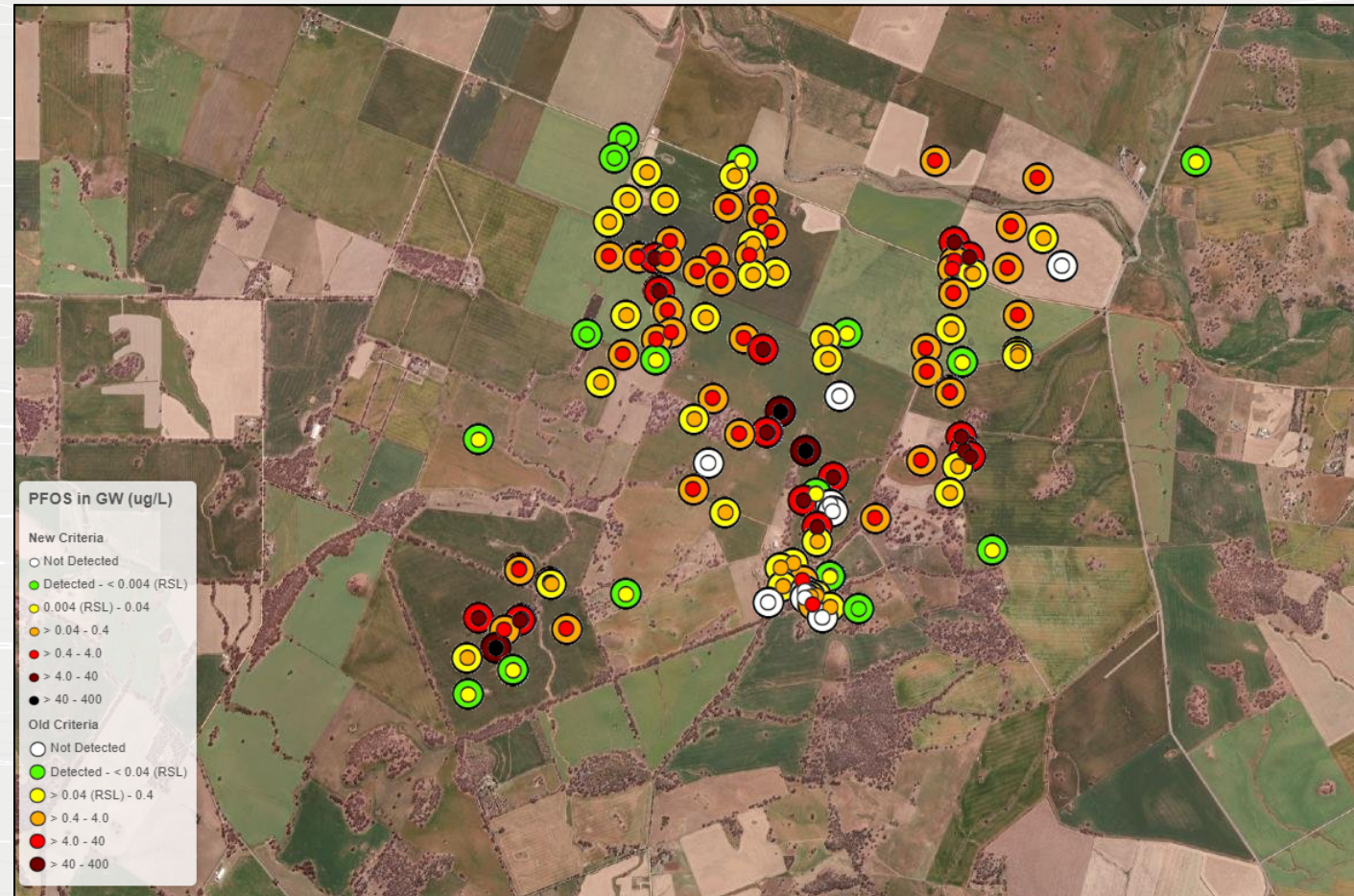
- *Previous PFAS data*
- *Hydrogeologic data and interpretations*
- *Utilities and infrastructure*
- *Historic imagery or site information*
- *Legacy contaminant data and plumes over time*
- *Deployed remediation technologies*



Use GIS to Support CSM Development

- Quickly assess changing criteria using queries and symbology
- Communicate changes and affected areas
- Identify area where historic lithological or hydrogeologic data may be available
- Identify existing sampling/data points that support delineation
- Visualize data comparability
- Identify data gaps
- Consensus development

Use of GIS queries and symbology to visualize effect of change in RSL criteria

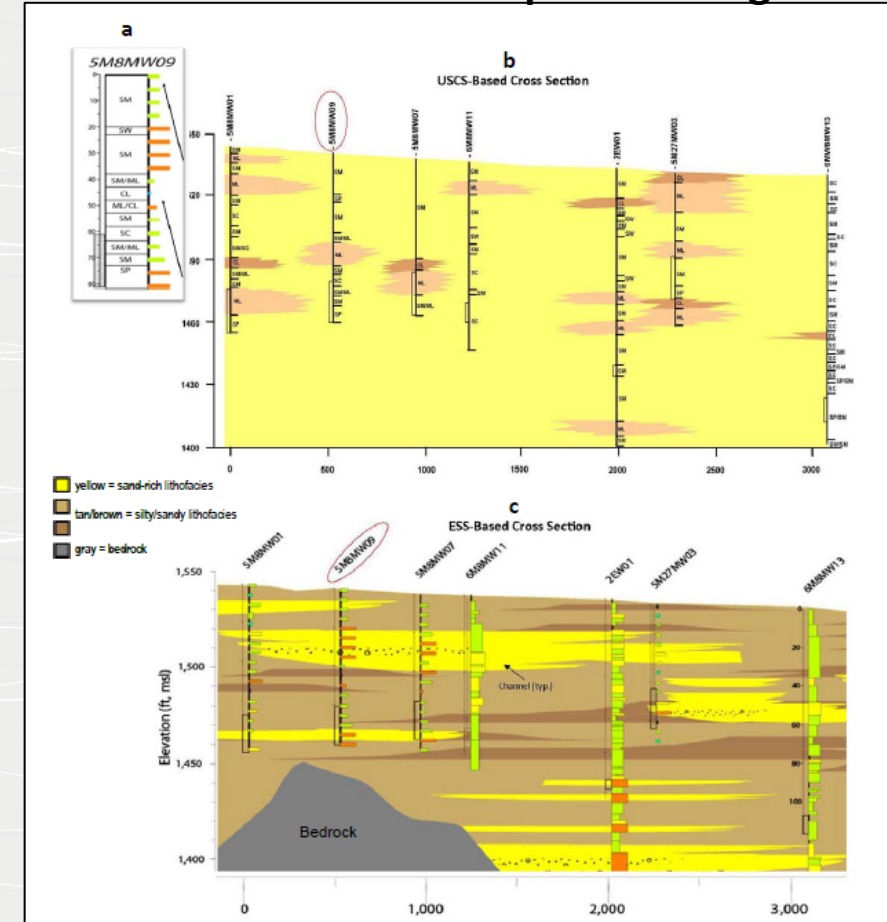


Lessons Learned

Use of High Resolution Site Characterization Tools, Environmental Sequence Stratigraphy (ESS), and other Best Practices as project scope permits

- *Collect HRSC data when project scope permits*
- *Evaluate data at different scales*
- *Develop understanding of depositional environment and hydrogeologic framework using ESS and historic/current site data*
- *Evaluate potential preferential pathways for groundwater*
- *Visualize changes and affected areas*
- *Identify data gaps*
- *Consensus development*

Cross Section Development using ESS

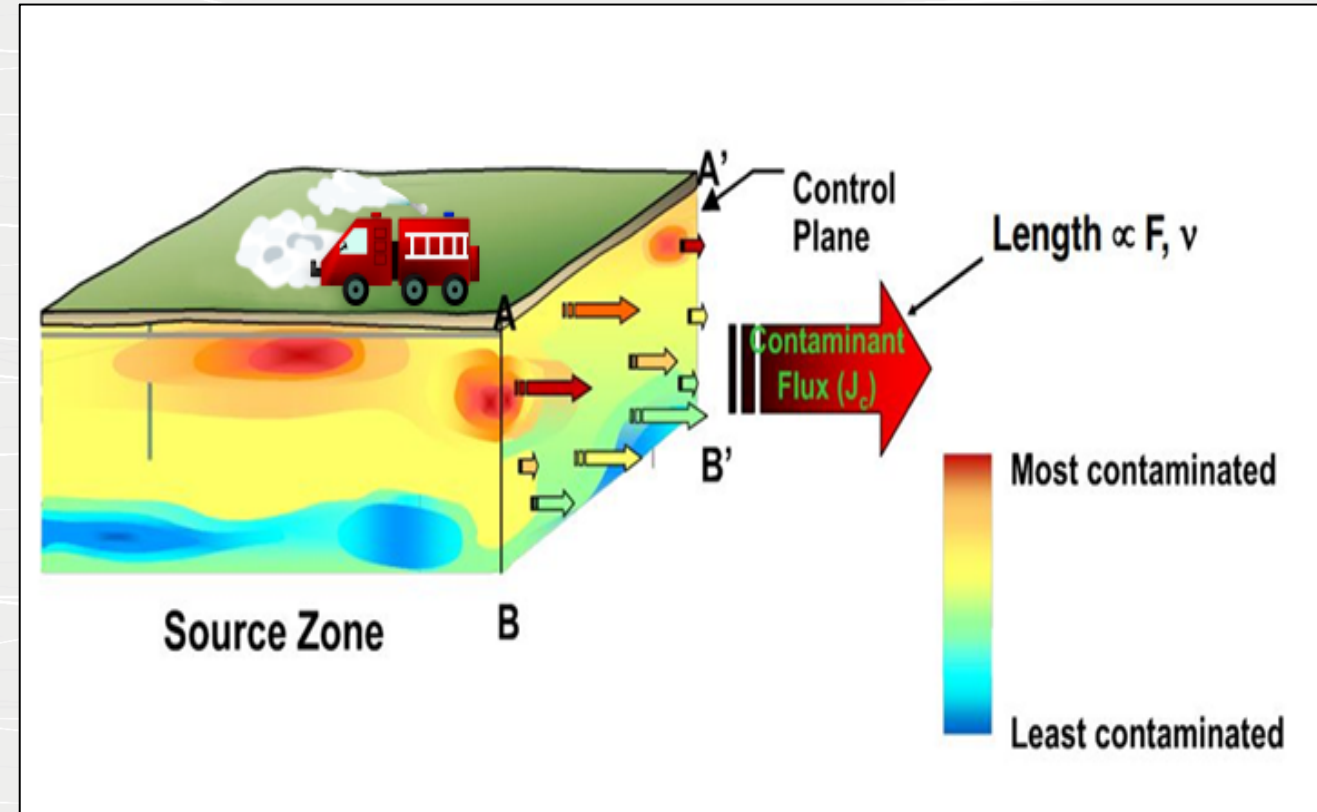


Source: Figure 9 from USEPA Groundwater Issue, Best Practice for Environmental Site Management (EPA/600/R-17/293, Sep 2017)

Lessons Learned

Collection of geochemical and geotechnical data to support evaluation and remediation considerations

- *Support further understanding of depositional environment and hydrogeologic framework*
- *Provide data to evaluate source areas, partitioning, and transport of different PFAS constituents*
- *Support understanding of contaminant mass flux and transport within hydrostratigraphic units*
- *Support geospatial understanding of data and changes over time*



Communicate Early and Often

- *Engage stakeholders in work plan development or review meetings*
- *Use GIS to support real-time, transparent data exchange*
- *Provide data and recommendations at identified project stages throughout the data-driven process to build consensus*
- *Consider varying policies and procedures while making recommendations*
- *Support public communication based on data in the context of the current state of the science*

And...Biggest, Less Technical Lessons Learned

- *Keep collecting data*
- *Stay patient – everything is evolving!*
- *Plan to evaluate the dataset with many lenses*
- *Keep learning - everything is evolving!*
- *Extensive communication is key*



Thank you

Discussion & Questions