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NATURAL RESOURCES

The LCSM Process and Data Interpretation

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Overview

- Regulatory requirements
- Integrating site-specific data into the model
- Common misinterpretations
- Identification of data gaps
- Quantitative model verification

Regulatory Requirements

- Revised Statues of Missouri (RSMo).319.109 Authorized the creation of the rules, and section 319.137 and addressed the promulgation process. This resulted in the creation, and promulgation of 10 CSR 26-2.

- 10 CSR-26-2.075 and 10 CSR 26-2.078 address initial free product recovery and site investigations.

- 10 CSR 26-2.078 (3) requires that investigations for Soil and Groundwater Cleanup follow a written procedure. (2005, or 2013 MRBCA Guidance).

Regulatory Requirements, continued

- Both the 2005 and the 2013 require that free product is recovered to the "maximum extent practicable", but only say that it's a site-specific determination.

- The purpose of the LNAPL Conceptual Site Model (LCSM) is to bring consistency to the process of making "maximum extent practicable" determinations on a site by site basis.

Integrating Site-Specific data into the model

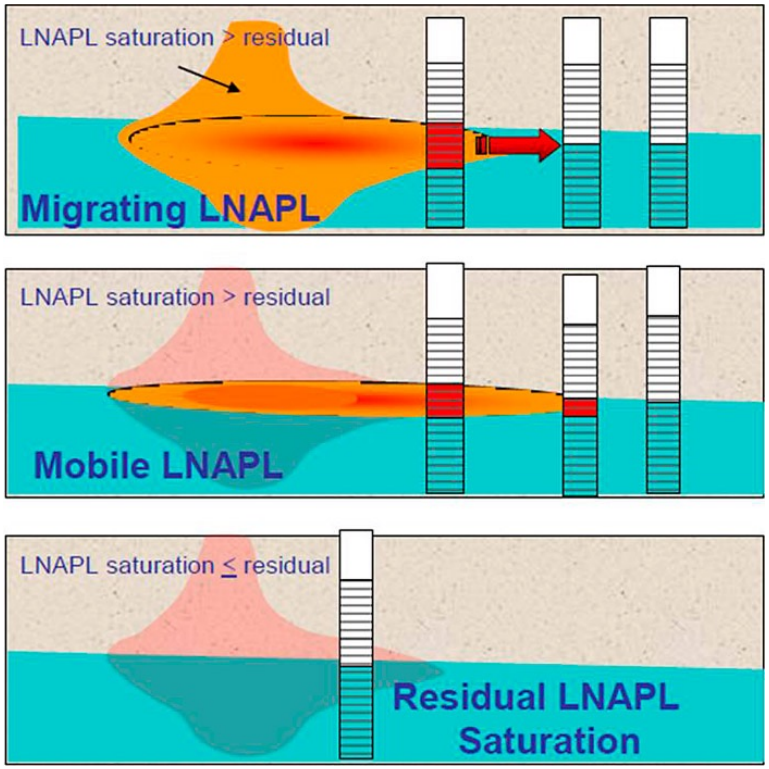
- LCSM's need to be more than a summary of site-specific data and conclusions. There needs to be discussion of how site-specific conditions cause the contamination distribution to vary from the idealized model.
- Contamination movement in the subsurface is controlled by capillary pressure. Capillary pressure is the pressure difference between the non-wetting phase (i.e., LNAPL) and the wetting phase (i.e., groundwater) in a multiphase system such as an LNAPL-groundwater system, and is controlled by wettability conditions and pore size at atmospheric conditions.

Integrating Site-Specific data into the model, continued

- Pore size varies by soil type. Sand is the largest particle and it has more pore space between its particles than silt or clay. Silt particles are smaller than sand, but larger than clay particles.
- The smaller the pore size, the higher the capillary pressure; the higher the capillary pressure, the more LNAPL is needed to force its way into groundwater. This makes for larger vertical, and horizontal distribution of LNAPL in the soil.

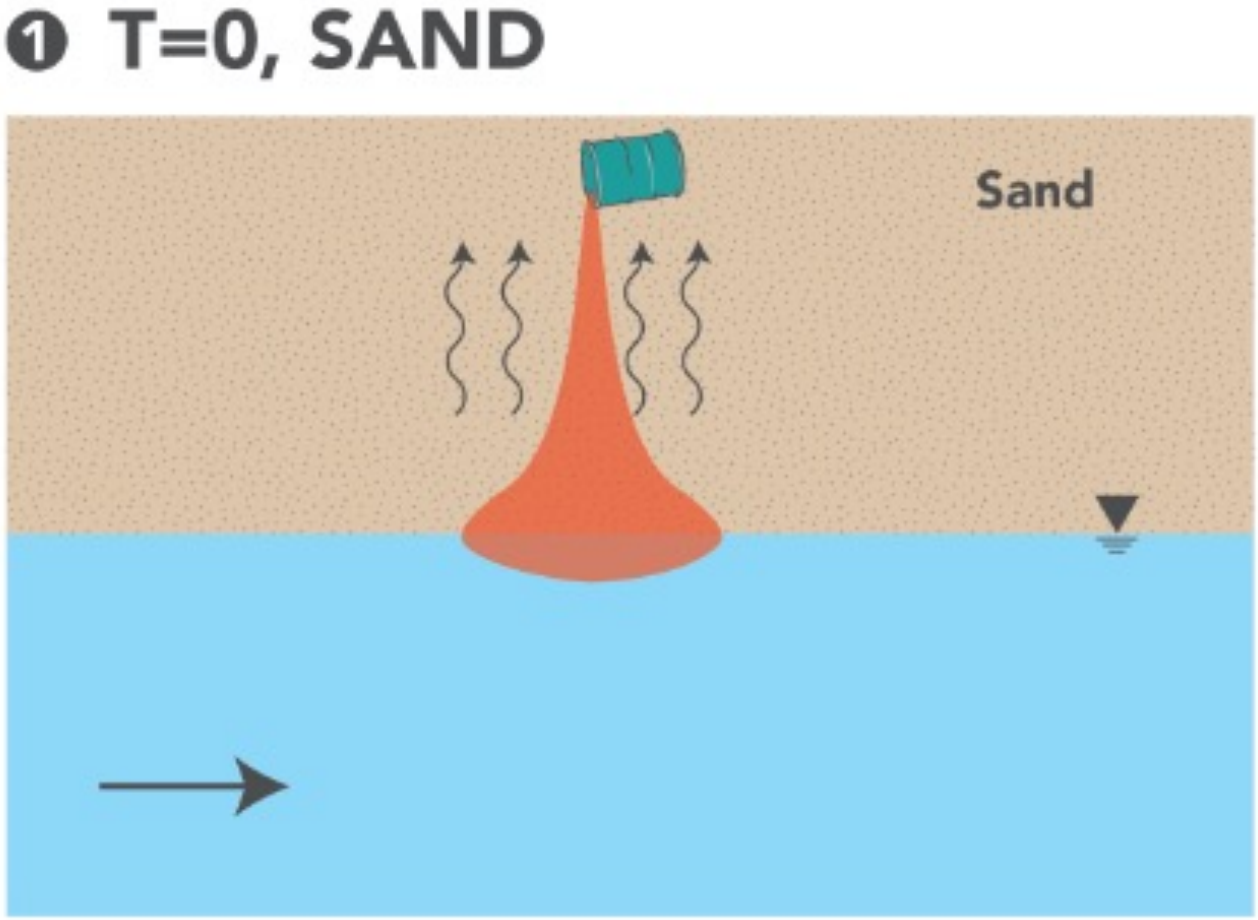
Integrating Site-Specific data into the model, continued

- The standard model (homogenous sand) taken from the Interstate Technology Regulatory Counsel (ITRC).



Integrating Site-Specific data into the model, continued

- Idealized model at time zero in sand



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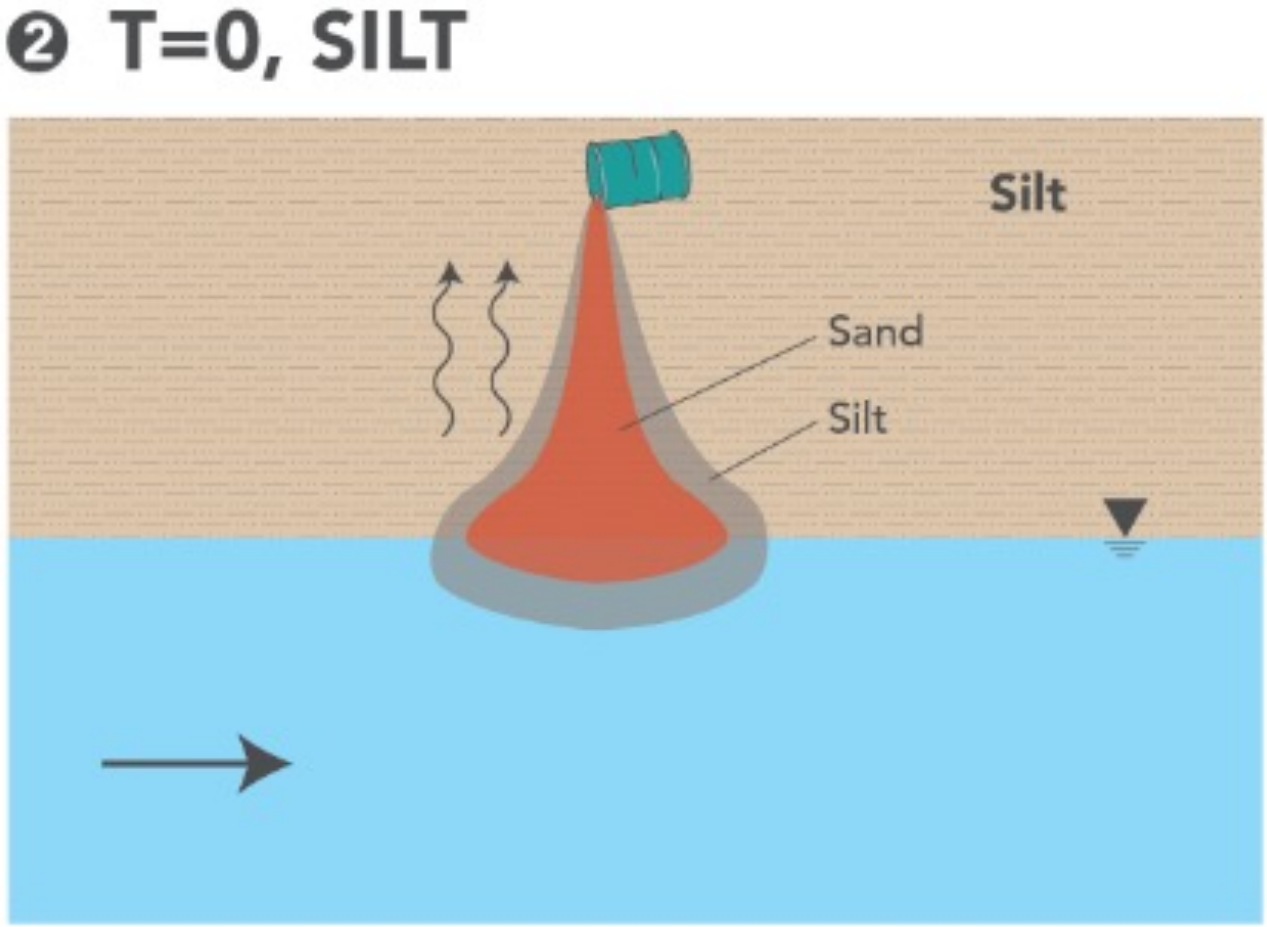
Integrating Site-Specific data into the model, continued

- Idealized model at time zero in silt



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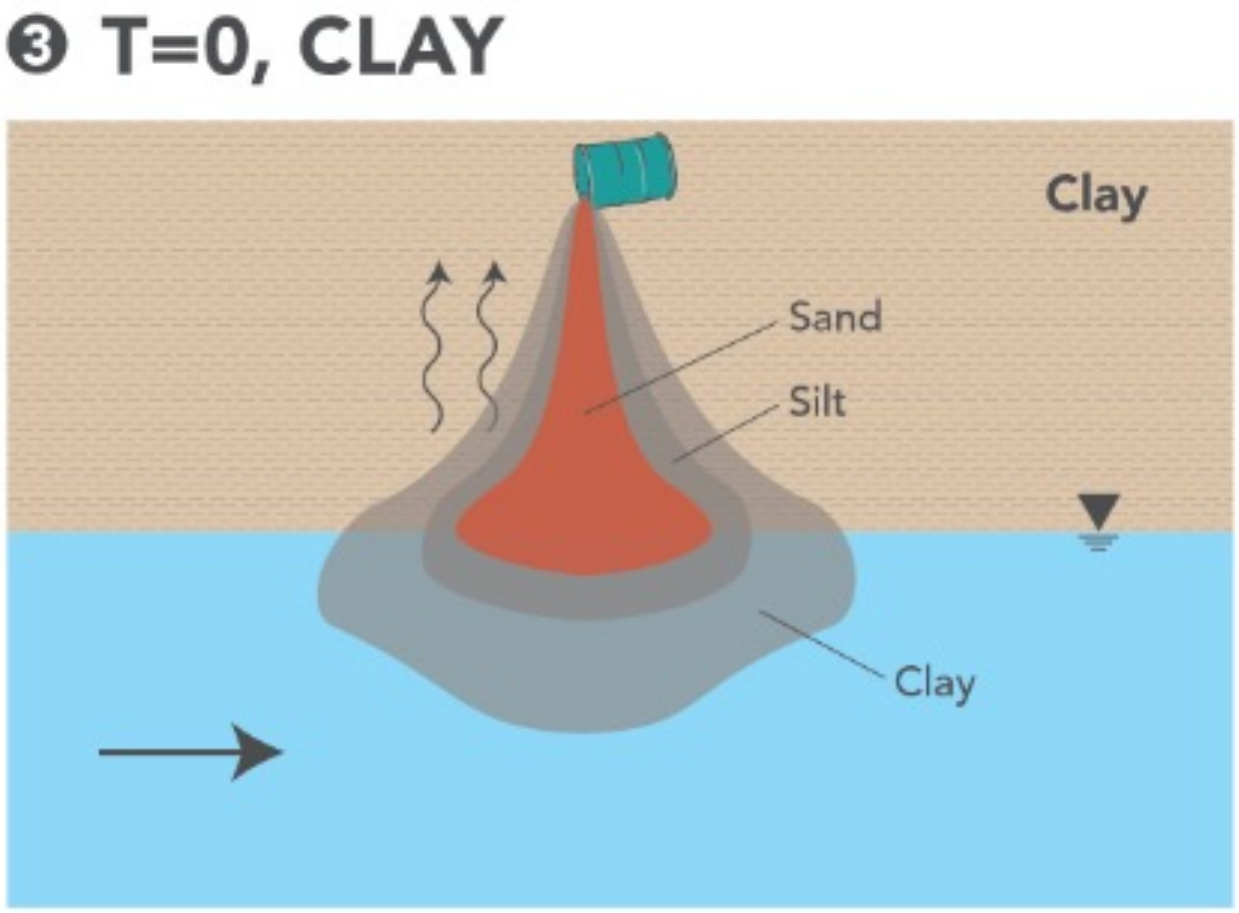
Integrating Site-Specific data into the model, continued

- Idealized model at time zero in clay



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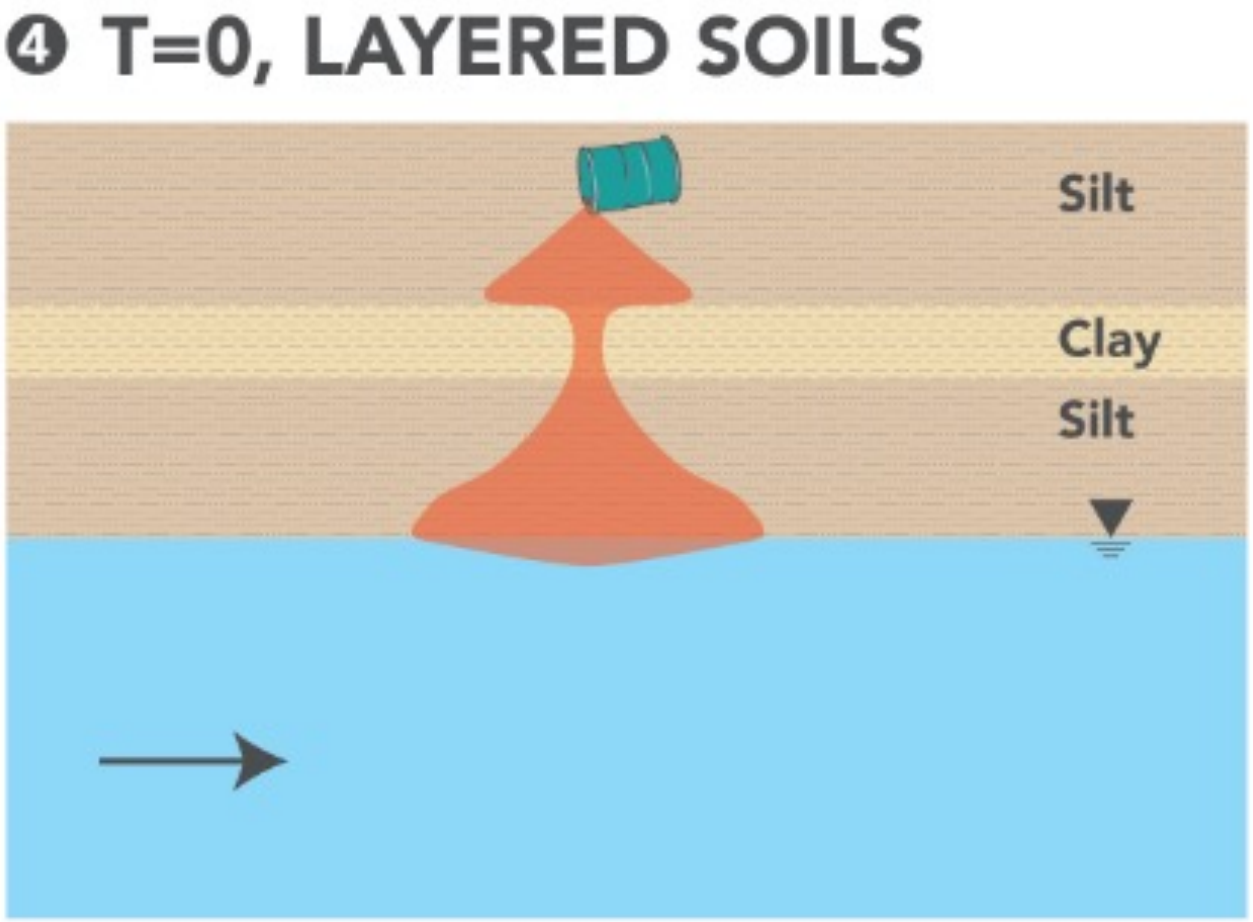
Integrating Site-Specific data into the model, continued

- Modeling with multiple soil layers.



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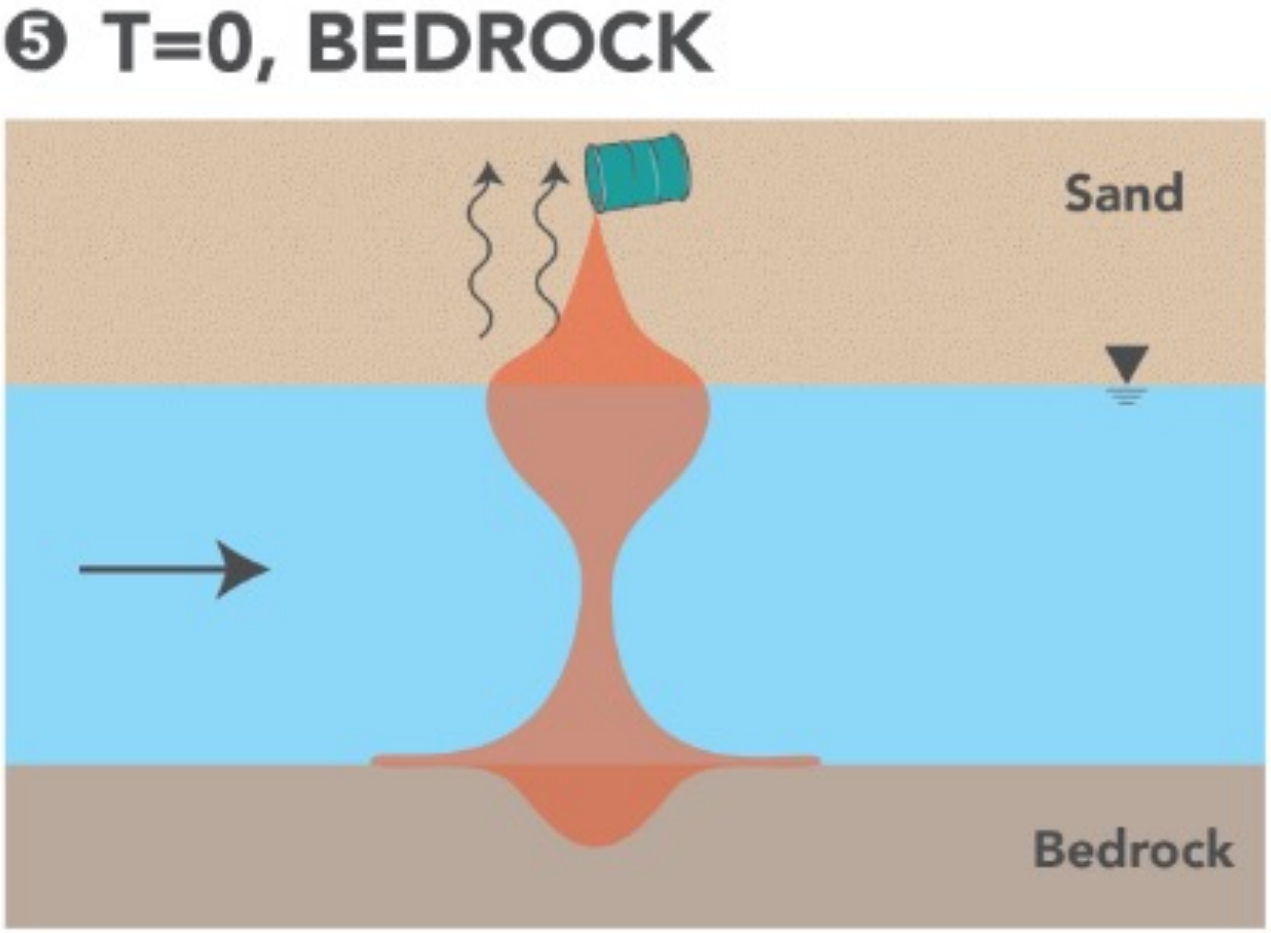
Integrating Site-Specific data into the model, continued

- Modeling with bedrock



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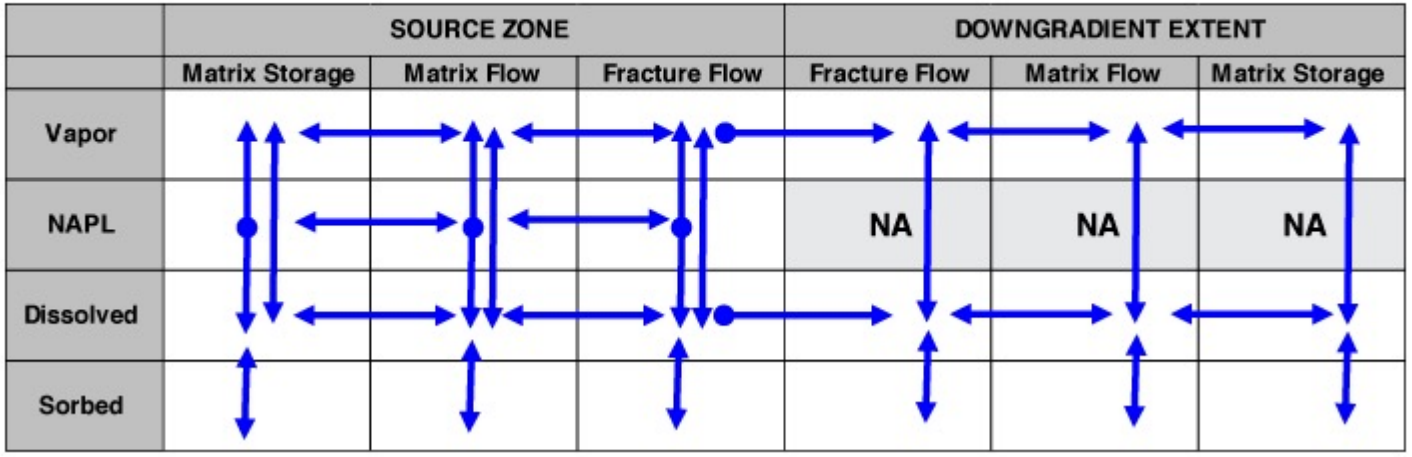
Bedrock Modeling

- Is a complete presentation on its own.
- ITRC's Characterization and Remediation in Fractured Rocks (ITRC FracRx-1) Appendix D. The 21-Compartment Model is a great reference.

Table D-2. The 21-Compartment Model with common contaminant fluxes between compartments (Solid arrows are reversible fluxes; dashed arrows are irreversible fluxes.)



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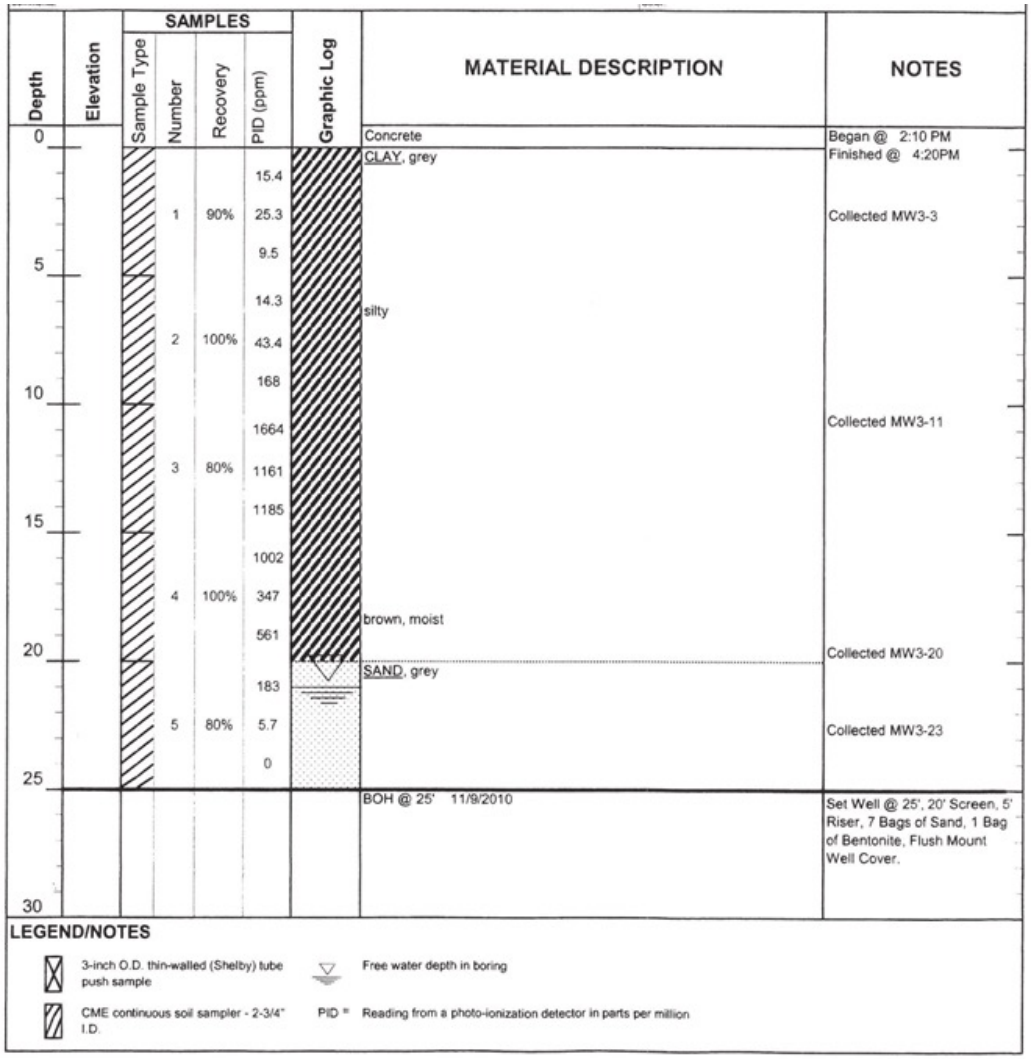
Common misinterpretations



Not all soils are Clay.

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Common misinterpretations, continued

- LCSM repeatedly referred to fine grained soils (clay) on-site that would make vacuum recovery impractical.
- Grain size analysis for the site showed type 2 soils that were 10%-Clay, 50%-Silt, and 40%-Sand. Also know as Loam.
- USDA's soil survey identified the soil at the site more specifically as Dundee silt loam.

Common misinterpretations, continued

- Cross sections, when and which wells.
- How evenly distributed is the LNAPL in soil? How close to the ideal case of circular spread is the soil contamination?
- How evenly is the presence of free product in across the site? How close to the ideal case of circular spread is the presence of free product?
- Is free product moving the same direction as groundwater?
- Primary cross section should be along the long axis of the free product plume.

Common misinterpretations, continued

- Misinterpretation:

The calculated LNAPL Transmissivity is less than 0.8 ft^2/Day therefore free product is not recoverable.

- What it actually says

The 0.1 to 0.8 ft^2/day range that is in the ITRC's LNAPL-2 document is a range based on the experience of the people who wrote that portion of the document that represents the range in which their experience indicates that hydraulic or pneumatic recovery is no longer worth the effort.

Common misinterpretations, continued

- LNAPL Transmissivity
  - Misinterpretation:

    That soil and LNAPL physical properties do not change significantly through time. What changes is LNAPL saturation resulting in LNAPL transmissivity decreasing in direct proportion to a decrease in LNAPL saturation.

  - What it actually says

    Transmissivity is a summary metric based more than just LNAPL saturation, such as seasonal fluctuations in water table, and variability in LNAPL impacts within the formation.

Common misinterpretations, continued

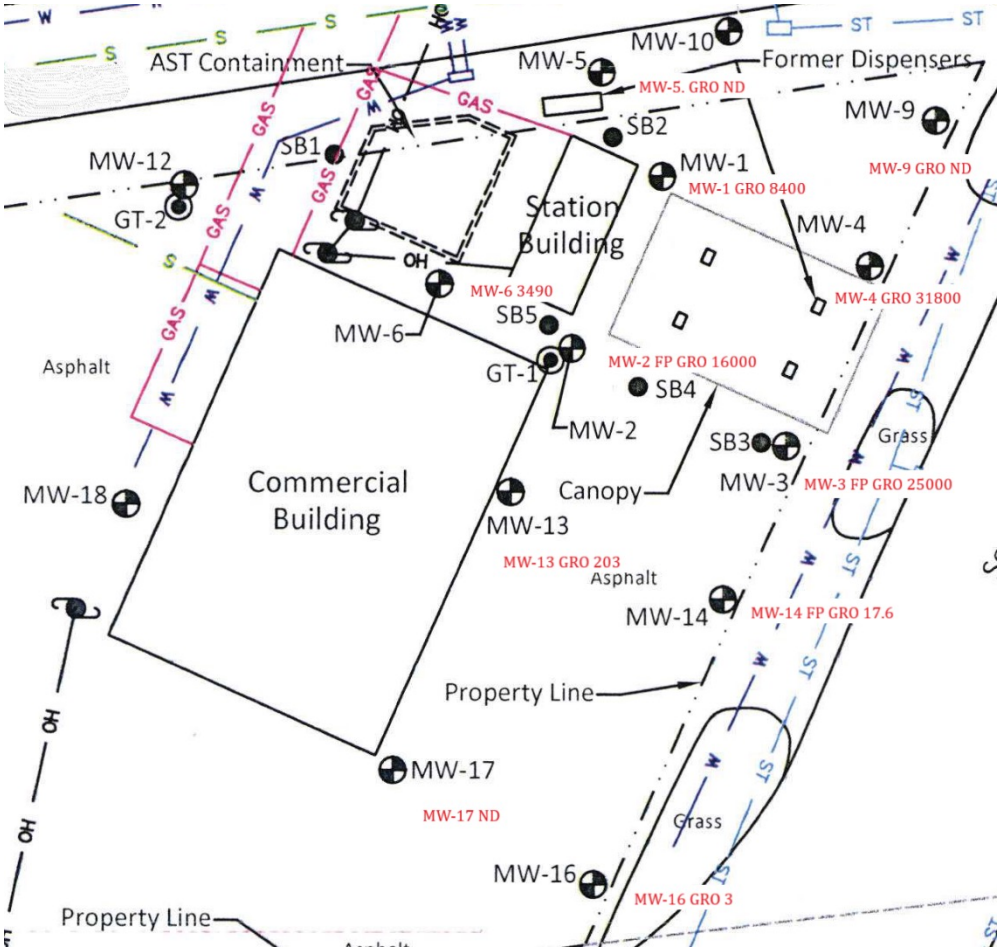
- LNAPL saturation calculations
- LCSM Tools: Conversion of TPH in Soil to NAPL Saturation. Applied NAPL Science Review January 2012
- Model estimates what percentage of the pore space is filled with NAPL based on TPH concentrations and the soil's physical characteristics.
- Having a saturation percentage below an arbitrary value does not mean that the NAPL is considered to be at residual saturation.

Identification of data gaps

- Free Product in a well is not the illness, it's a symptom. The problem is the over saturation of soils with LNAPL. TPH GRO iso-contour maps would be really helpful.
- Horizontal data gaps. How far between borings? 25 or less, fine. More than 50? What are the soil concentrations? How circular is the soil contamination (aka close to ideal).

Identification of data gaps, continued

- Are additional borings needed south of MW-14?



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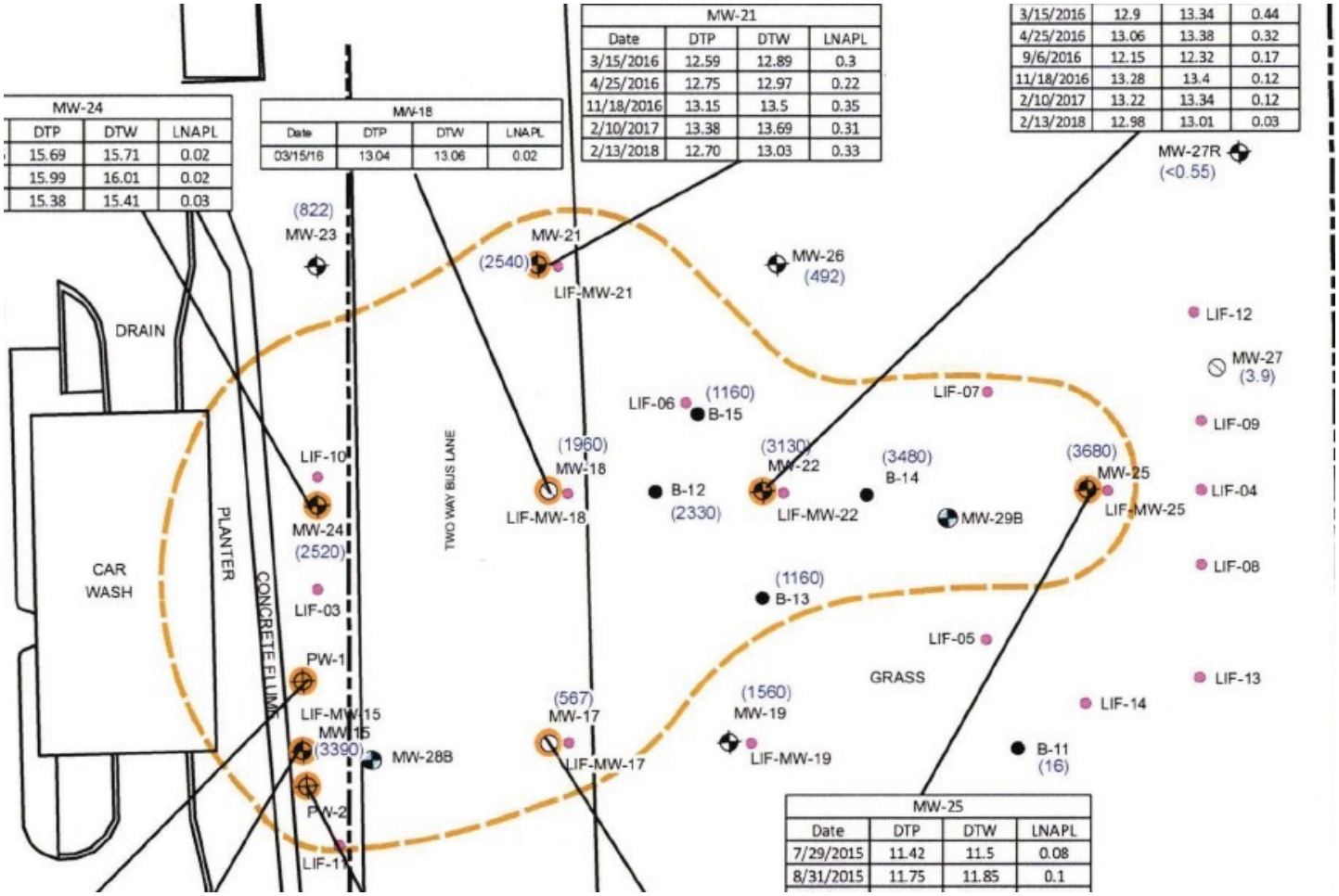
Identification of data gaps, continued

- Vertical data gaps. Is the bottom of the boring actually refusal on bedrock?

Identification of data gaps, continued



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Quantitative model verification

- The purpose of the LCSM is to not only document where the LNAPL is, but to determine if it is recoverable.
- The data in the LCSM needs to be used to evaluate the potential effectiveness of various technologies.
  - Section 6 of ITRC's LNAPL-3 is a good reference
- Based on the LCSM. Preform a pilot test of the technology identified as the most likely to succeed.

Questions?

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