

# Enhancing the Hydraulic Conductivity of Horizontal Remediation Wells



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# Overview

- **Factors**
- **Design**
- **Construction**
- **Development**



# Factors Affecting / Affected by Hydraulic Conductivity

- **Physical properties**
- **Treatment schedule**
- **Lithology**
- **Well Design**
- **Drilling method**
- **Well Construction**
- **Well Development**
- **Subsurface Environment**



# Physical Properties

## CONTAMINANTS TREATMENT

- **Contaminants:**  
highly mobile? (MTBE) viscous? (Tar, PAHs)
- **Treatment:**  
gaseous?(SVE/sparge)  
liquid? viscosity, temperature...



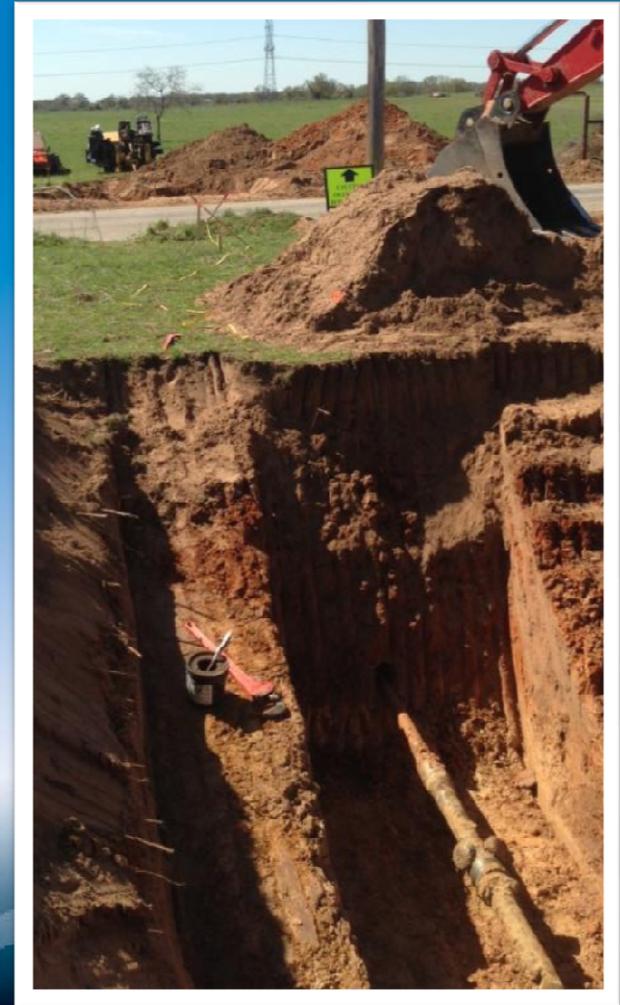
# Treatment Schedule

- Treatment method: injection, extraction
- Treatment duration: Once? Years?
- Seasonal variations
- Operational variations (pulsing, steady state)
- Treatment transitions over time (start with air sparge, transition to injection)



# Lithology/Geology

- **Grain size distribution**
- **Cementation**
- **Fractures / Jointing**
- **Compaction**
- **Depositional environment**
  - High energy – framework supported
  - Lower energy – matrix supported



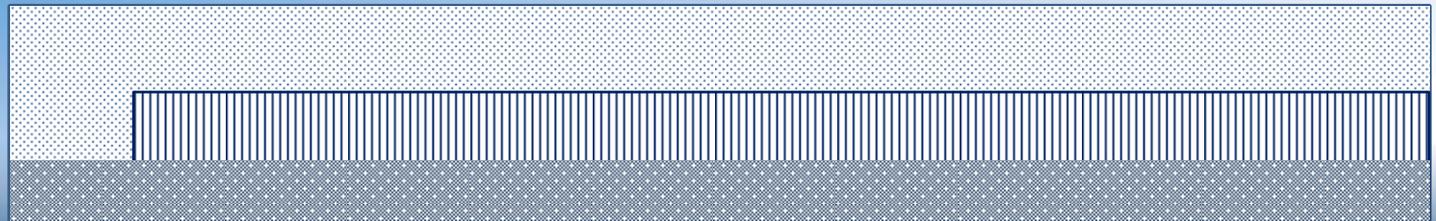
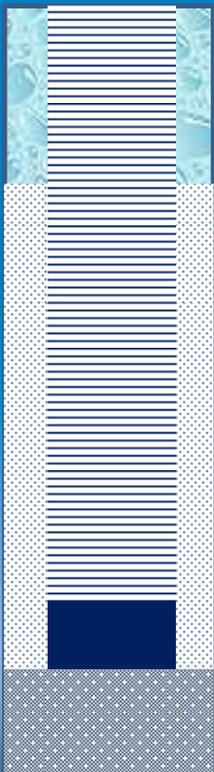
# Horizontal Well Design

- **Location, location, location!**
  - Well must be where the contaminants are....
  - Horizontal wells are linear – cross subsurface features
  - Consider hydrogeological features – ridges, depressions
- **Less leeway for positional error on NAPL recovery**
- **Take advantage of horizontal well benefits**
  - Vertical curves/inclines
  - Horizontal curves



# Horizontal Vs. Vertical

- **Screen orientation**  
(fines drop into screen, instead of into “sump”)
- **Screen design (slot type, etc.)**



# Drilling Method

- **Compaction tooling vs. cutting tools**
- **Cuttings removal**
  - Mud system sizing
  - Fluid volume
  - “Bottom’s Up!”
- **Drilling fluid**
  - Biopolymer vs. bentonite
  - Well development



# Past Construction Practices

- **Sand packs**
- **Geotextile wraps**
- **Exotic well screens**



# Well Construction

- **Sand pack?**
  - Use of centralizers
  - Sand injection

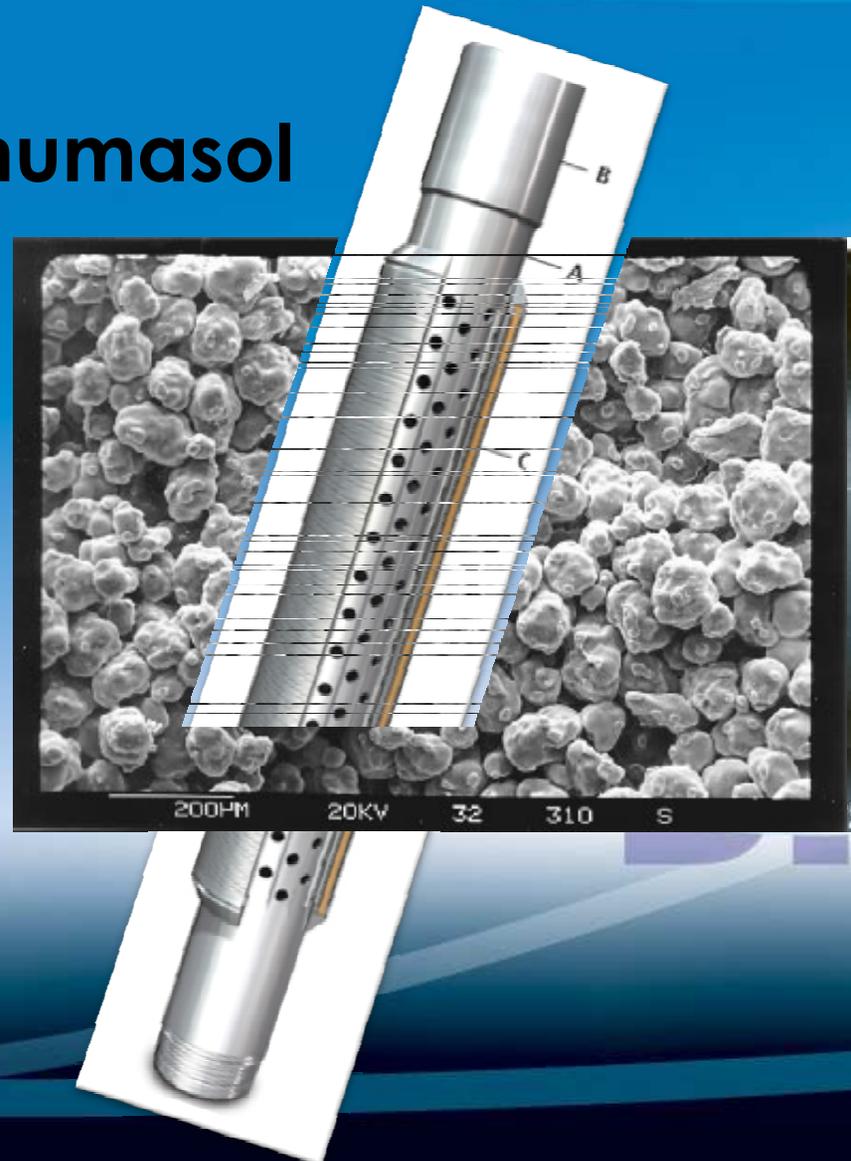


# Geotextile Wraps



# “Exotic” Screen Materials

- Johnson/Schumasol
- Hydroquest
- Pre-pack



# Interior Integrated Filter

- **Enviroflex**



# Well Development

- **Sufficient to remove wall cake and/or excess drilling fluid**
- **Challenges:**
  - **Drilling equipment not optimized for well development (slow carriage speeds, difficult to surge)**
  - **Vadose zone wells**
  - **Low-yield aquifers**
  - **Low open area wells**



# Vacuum/ Jetting



# Best Construction Practices

- **Soil removal (cutting) tooling**
- **Biopolymer or bentonite drilling fluids**
- **Bare (slotted) or integrated filter screens**
- **“Natural pack”**
- **No centralizers**
- **Enzymes or surfactants for development**
- **Jetting and vacuum surging**



# Environmental Factors

- **Biofouling**
- **Chemical encrustation**



# Design Considerations

- **Well characterized site**
- **Topography data**
- **Optimize well depth and diameter**
- **Appropriate well design**
- **Select experienced contractor**



# Questions and Contact Info

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