

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...



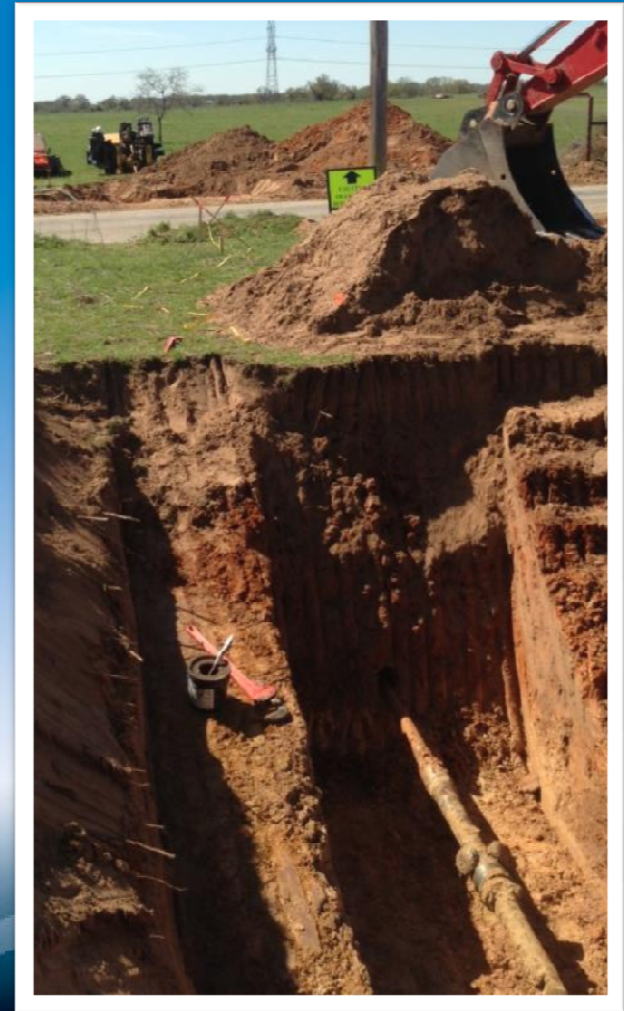
Treatment Schedule

- 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



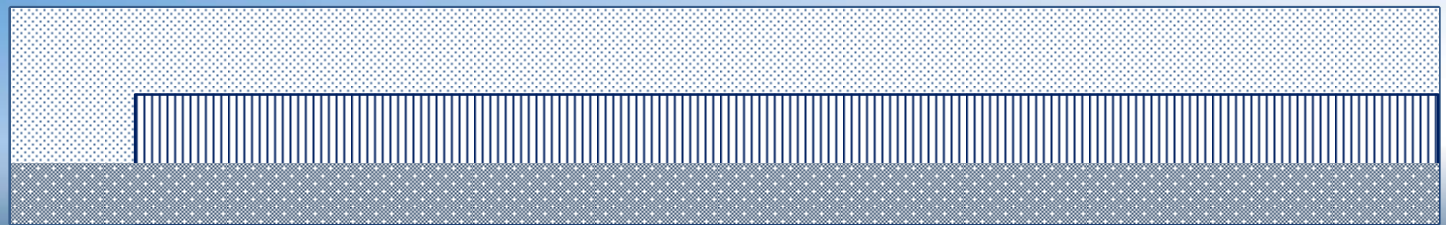
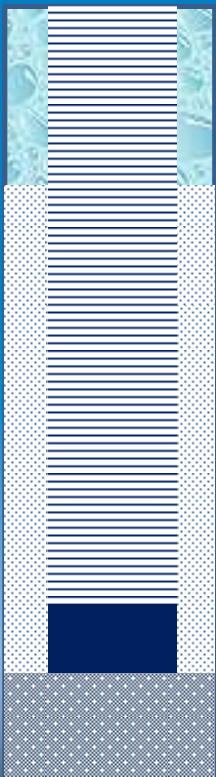
Horizontal Well Design

- **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



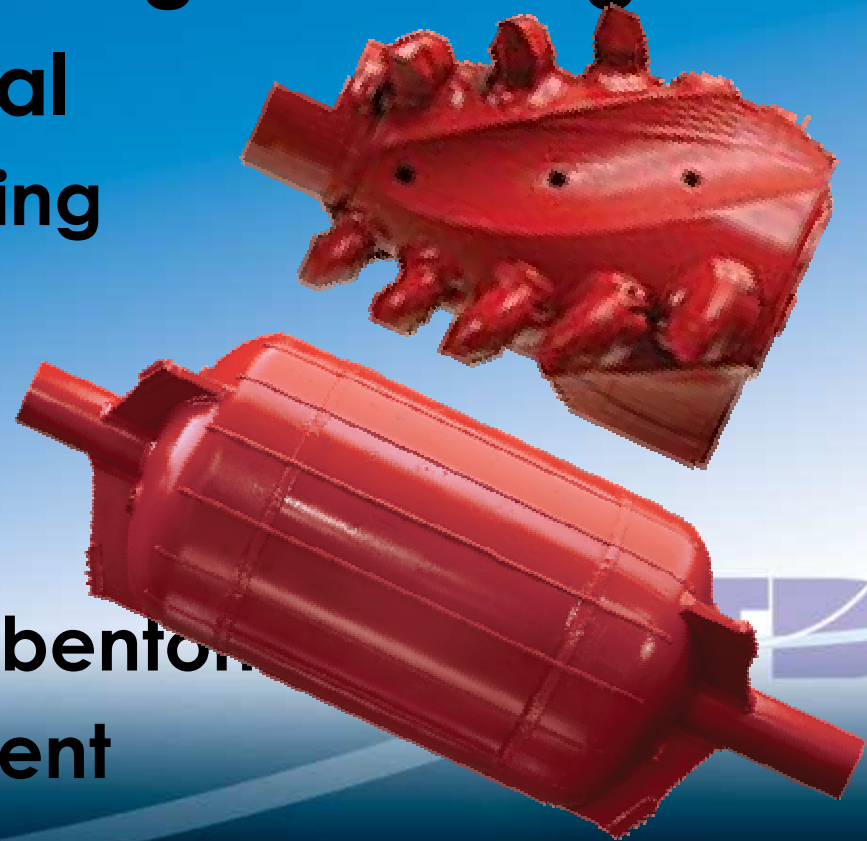
Horizontal Vs. Vertical

- **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

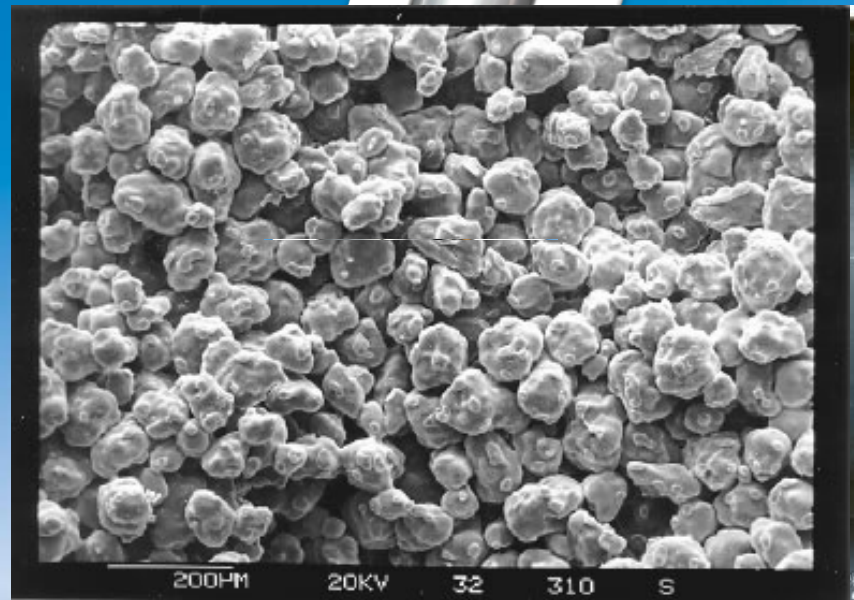


Geotextile Wraps



“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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