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Shifting Strategies as a Result of Reduced Federal Funding (A Case Study and Actionable Practices)

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Key Presentation Components

- A Case Study with Parallels
  - Funding for DoD and SuperFund Environmental Cleanup versus Cost to Complete and Projected Lifecycle Costs

- What strategies can we use to address disconnect between funding versus projected costs?

- What does implementation of these strategies look like?

DoD Cost to Cleanup Liability and Annual Funding

YEAR	FY08	FY09	FY10	FY11	FY12	FY13	FY14	FY15	FY16	FY17
DoD Remaining Environmental Cost To Complete (CTC) Cleanup Liability	$34.50	$32.30	$30.00	$29.00	$29.00	$27.60	$27.20	$26.80	$27.20	--
CTC Δ	--	$2.20	$2.30	$1.00	$0.00	$1.40	$0.40	$0.40	($0.40)	--
DoD Annual Restoration Funding	$2.08	$2.02	$2.23	$2.07	$2.03	$1.83	$1.98	$1.83	$1.37	$1.21
Return on Investment (CTC Δ - DoD Ann. Res. Funds in Prior FY)	**--**	**$0.12**	**$0.28**	**($1.23)**	**($2.07)**	**($0.63)**	**($1.43)**	**($1.58)**	**($2.23)**	**--**

1) All values in billions of U.S. dollars.
<u>*Compiled from:*</u>
-FY2012 Defense Environmental Programs Annual Report to Congress
-FY2015 Defense Environmental Programs Annual Report to Congress
-Transcript of ASD Conger statement before the House Energy and Commerce Committee Subcommittee on Environment and the Economy, September 11, 2015
-2016 Financial Report of the United States Government, Notes to the Financial Statements, Note 13. Environmental and Disposal Liabilities

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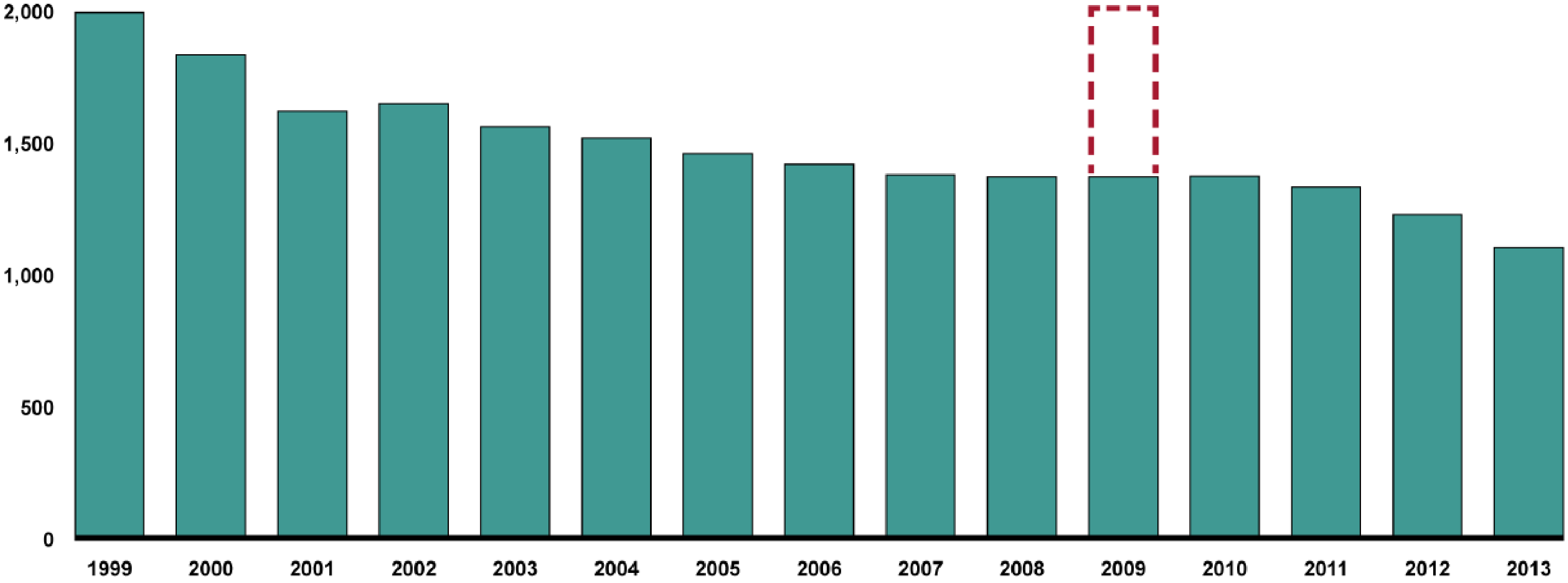
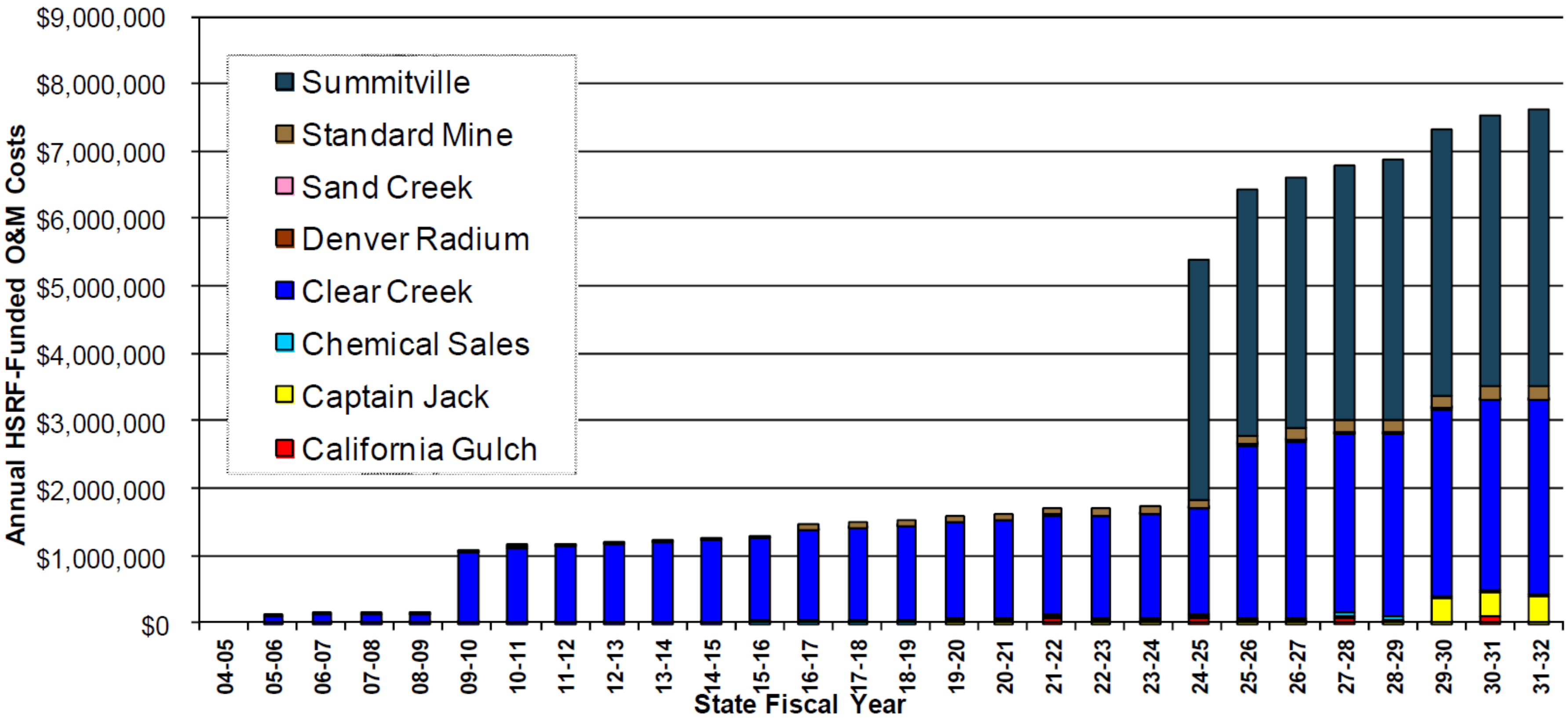
EPA SuperFund Appropriations



1) All values in millions of U.S. dollars.
From:
-GAO-15-812

Colorado CERCLA Program Site Costs



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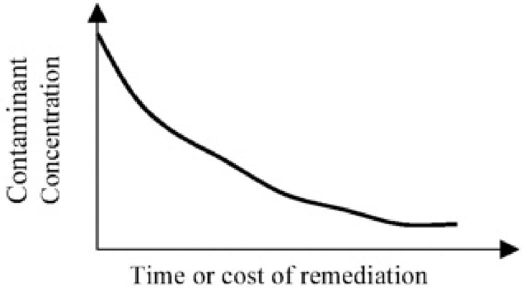
1) All values in U.S. dollars.
<u>*From:*</u>
-Colorado DPH&E, November 1, 2014 Report

Why the disagreement between cost to complete liability and funds expended/projected?

- **Newly discovered liabilities.**
  - Should be decreasing.
  - Previous source investigations not always accurate.

- **Nature of remediation.**
  - Easiest reductions come in the beginning.
  - MNA and long-term monitoring.



- **Method of cost to complete.**
  - Typically based on project lifespan instead of closure.
  - Assumes advances will reduce costs.
  - FY14 DoD estimated environmental liability at $58.6B, but CTCs were $27.2B.

  From: FY 14 DoD Agncy Financial Report

  - In 1994 EPA estimated environmental liability at $75B, completion 2075.

  From: 1994 CBO Study

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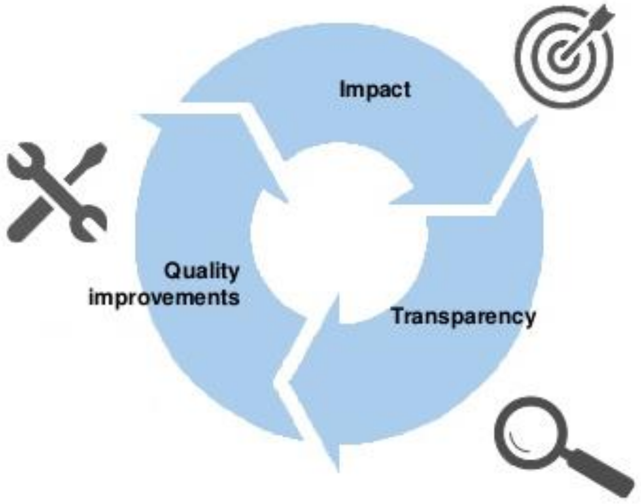
Costs will outpace funding. So what strategies can be used to reduce costs?

- Must understand why contaminant levels are not decreasing.
- Must focus funding where biggest long term impacts can be made, while still mitigating risk.
- Must only monitor what is necessary for remedy performance and protectiveness.
- Must use modern sampling and characterization tools.
- Aggressive, precise actions can reduce costs and remedial timeframes.



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Must understand why contaminant levels are not decreasing.

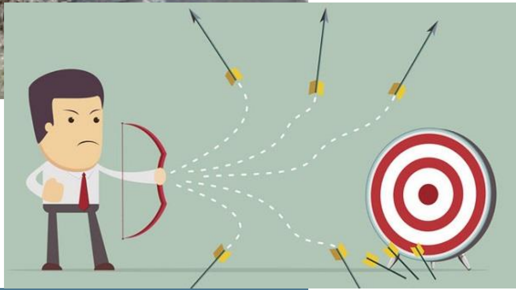
- Did the source investigation correctly/precisely identify the source?

- Did the remedy effectively/precisely target the source?

- Was the remedial action effective?

- Were incorrect data/assumptions used to model remedial timeframe?

- Does the monitoring accurately reflect the subsurface conditions?



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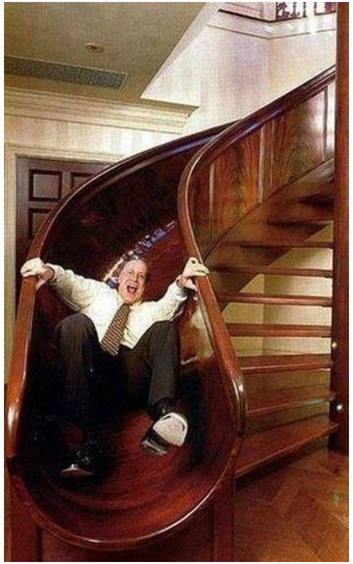
Must focus funding where biggest long term impacts can be made, while still mitigating risk.

- Do the stakeholders have tunnel vision that focuses efforts on those parts with most risk, at the expense of more costly and lengthy parts of the cleanup.

- Need to avoid a stepwise approach where part C can't be done until parts A and B are complete.

- When there is delay in addressing the biggest and most costly impacts then advantages of other strategic mitigations cannot be realized.



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Must only monitor what is necessary for remedy performance and protectiveness.

- Monitoring optimization should be a part of every remedy.

- Monitoring optimization approach must be applied consistently, use well-documented (and accepted) procedures, and have formal decision logic and evaluation capabilities.
  EPA 542-R-04-001a, https://frtr.gov/decisionsupport/DST_Tools/maros.htm

- Must have stakeholder buy-in on the goals or outcomes won’t be accepted.

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Must use modern sampling and characterization tools.

- Groundwater low flow sampling was never meant to be the gold-standard.
- Other methods rely on the same principle, have been studied for over decade, yet are not uniformly accepted.
- Lack of acceptance primarily due to field comparison studies in the literature, but sampling was typically not contemporaneous.
- Precision field characterization tools are critical to understanding discrete contamination in the subsurface.

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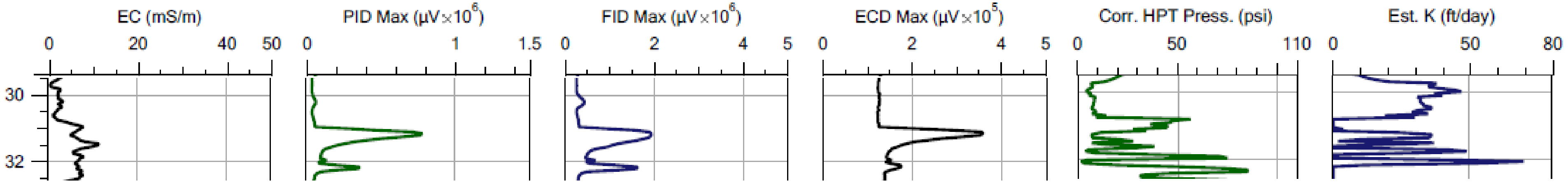
Aggressive, precise actions can reduce costs and remedial timeframes.

- Not withstanding all the other critical items already discussed, aggressive, precise actions can have a significant impact.

- The science and practice of contaminant hydrogeology, fate and transport, and remediation has advanced dramatically in the last 30 years.

- For example, the bulk of subsurface contamination exists in thinner more discrete layers than previously thought.



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A Case Study

Some agencies are already seeing the benefits of this approach.

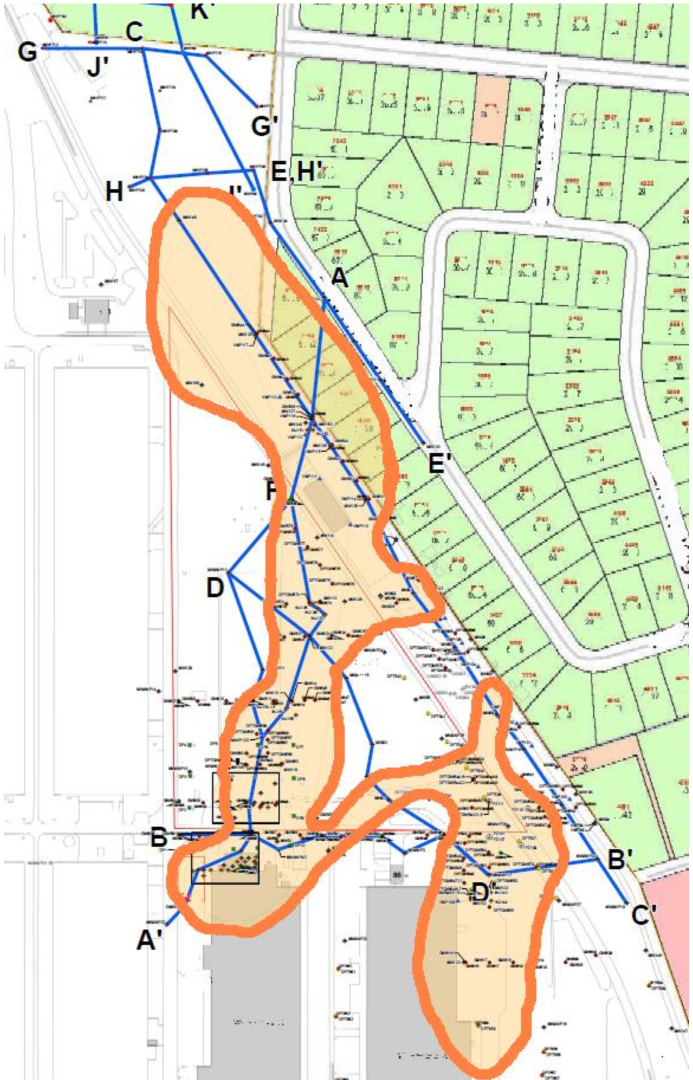
- **Background:**
  - Location: central Virginia piedmont
  - Status: multiple OUs many in the RA-O stage
  - Source: mostly chlorinated solvents, from former military activities, RODs signed in late 1980s thru early 1990s
- **Focus:**
  - One OU with potential offsite impacts and a school and residences.
  - Historical remedial activities included dig and haul and DPE.
  - MNA and long term monitoring was to be the remedy but unfavorable geochemical conditions, plume instability, and lingering contaminant levels spurred contingency actions.

Chlorinated Solvent Plume, 2014

- The source area that was historically excavated is near the south end of A-A’.

- Initial transport may have occurred along now abandoned infrastructure.

- Highly investigated. Hundreds of monitoring wells.



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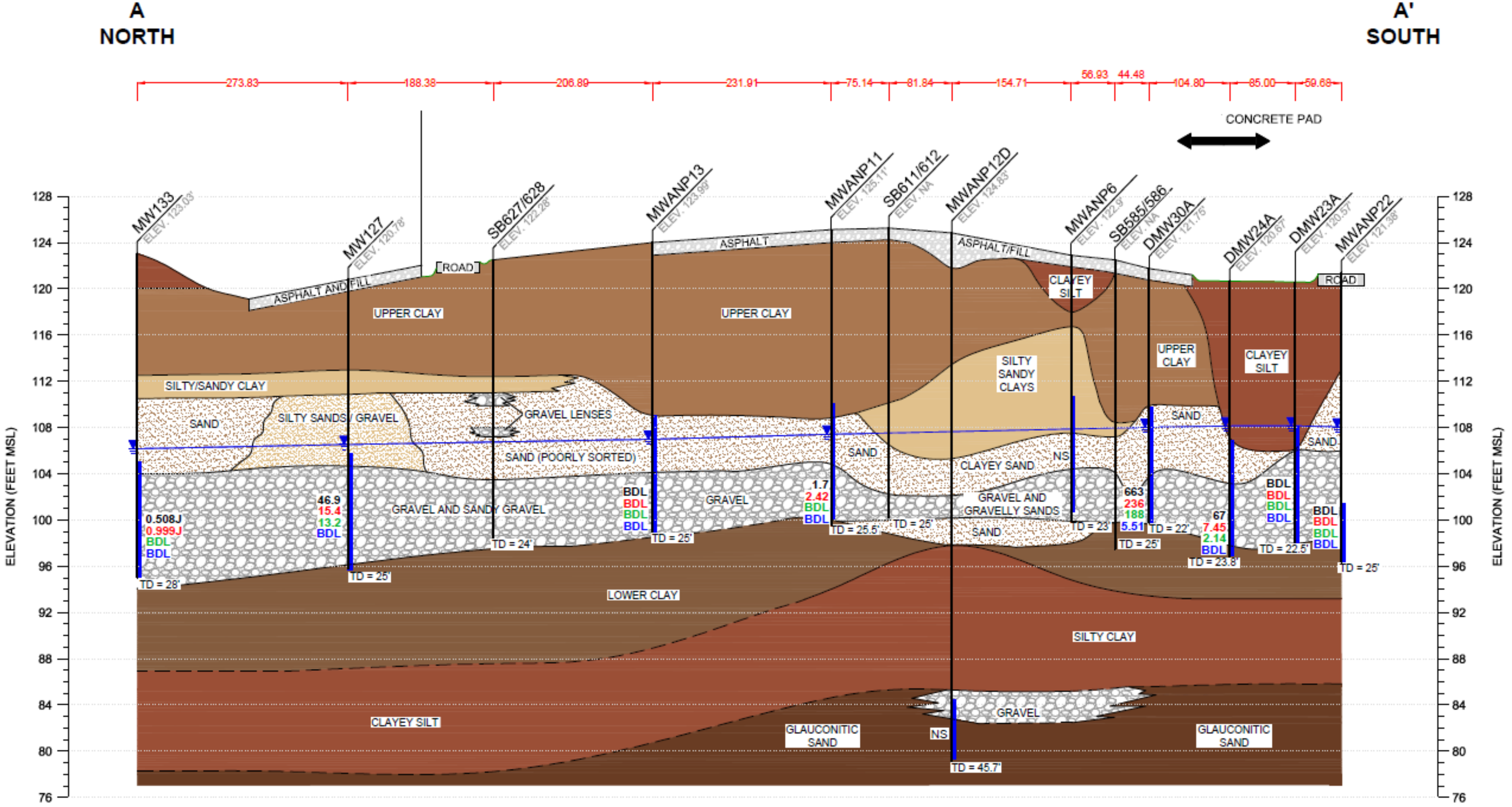

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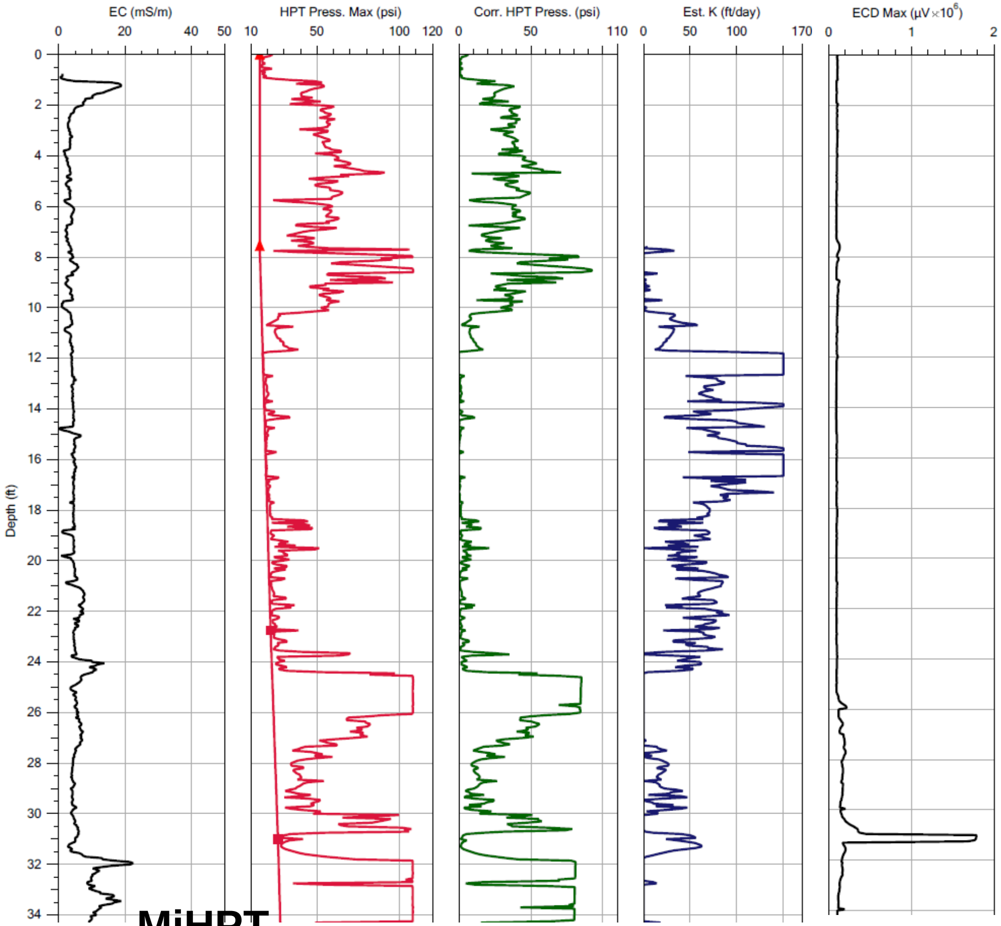
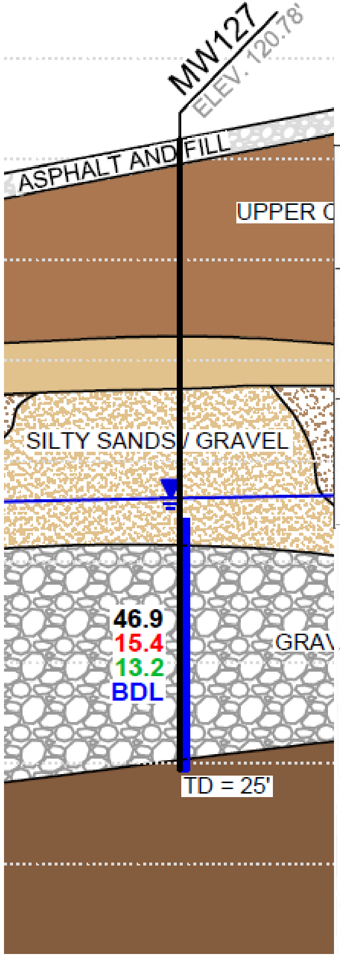
A-A’ Cross Section, 2014

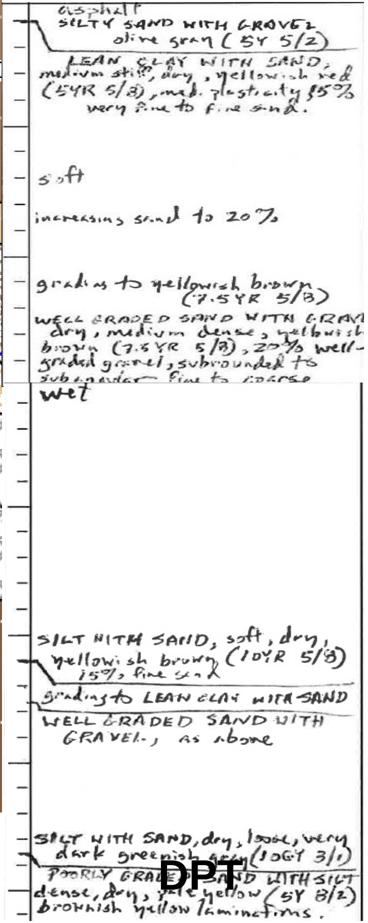
Use of modern sampling/characterization tools



MiHPT



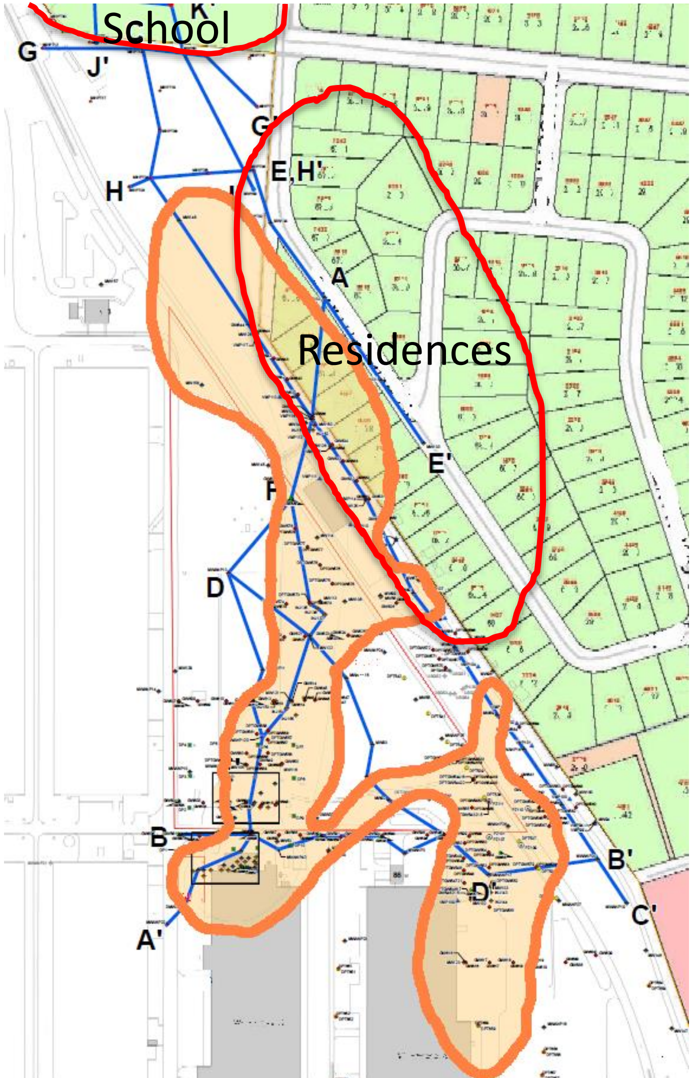
SPT



DPT

Other Issues

- Efforts focused almost exclusively on potential receptors/mitigation.
- Limited effectiveness of remedy on decreasing concentrations.
- Stakeholders felt level of monitoring was minimum needed but no optimization had been done.
- Plume not stable in many areas.
- More costly liabilities (issues) not aggressively pursued due to lower perceived risk.



What was done?

- 40+ MiHPT borings to more precisely identify where contaminants were.
- Two long term pumping tests, low-yield (<5 gpm each), that also provided capture and stabilized the plume.
- Four small scale targeted enhanced reductive dechlorination injections.
- Subsurface/ambient vapor survey to rule out of site risk.
- Source area directed groundwater recirculation system.

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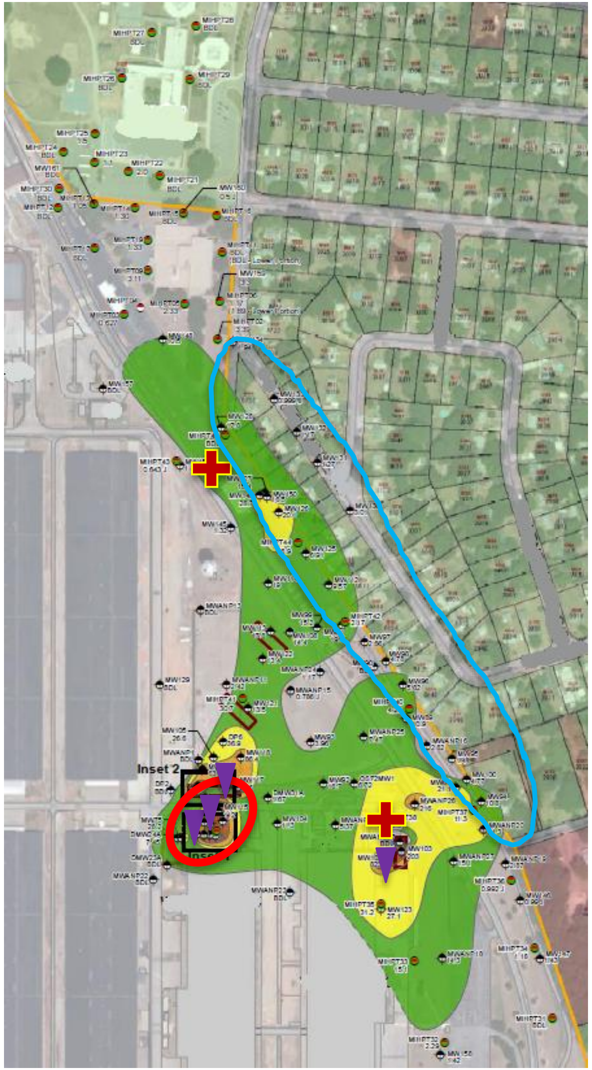

What else?

- Performed offsite and near boundary ERD injections in other OUs to reduce future costly off installation property easements.

- Performed targeted ERD injections in other OUs to knock down source area concentrations.

- Performed monitoring optimization and sampling method improvements at the three largest OUs, resulting in over $250k in savings per year.

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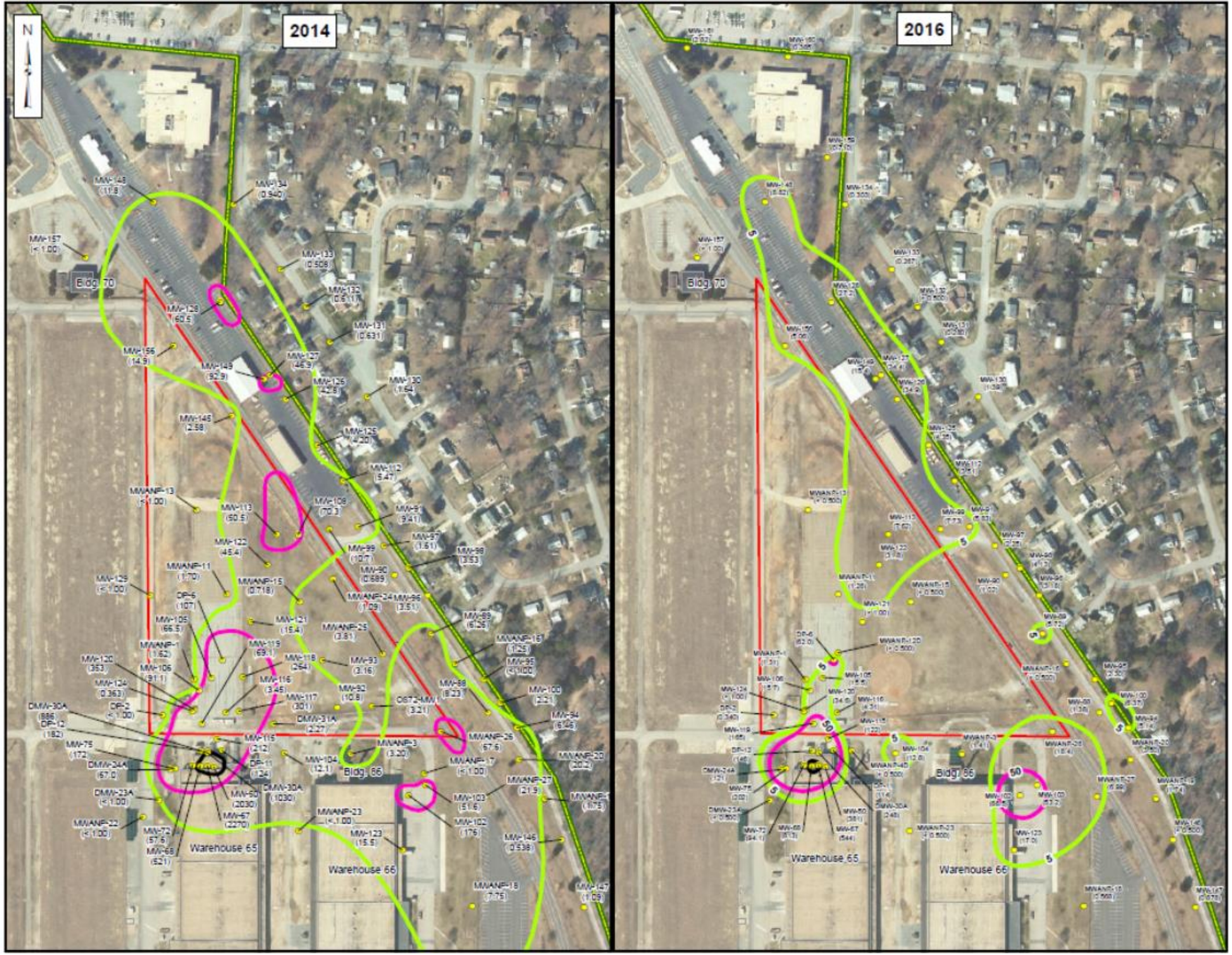
Did it work?



Remediation efforts started in 1991.

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How does this translate to other work?

When funding is stagnant or declining, a shift in strategy is needed to reduce overall costs and shorten overall project lifespan, while still meeting goals.

What has been described so far is really a ***Process***:

1. **Understand why contaminant levels are not decreasing/changing**
   - We had a plan, but we're not seeing the results. Why not?
   - Will our plan provide the correct answers in a reasonable timeframe?
   - Communicate why, and what is the impact of staying the course?

2. **Focus on funding where biggest long term impacts can be made, while still mitigating risk**
   - We cannot do all things everywhere cost effectively.
   - There must buy-in to do those things where the biggest impact overall can be made.

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How does this translate to other work?

<u>The Process, Continued</u>**:**

3. **Must optimize and only monitor what is necessary for remedy performance and protectiveness.**
    - An agreed upon, logic-based optimization strategy must be used.
    - There must be buy-in on the process and the results of the optimization.
    - Need to avoid the investment pitfall and confirmation bias.

4. **Must use modern sampling and characterization tools.**
    - The world is changing around us, and so is science.
    - In order to derive the most beneficial results, we must use the most up-to-date tools.

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How does this translate to other work?

***The Process, Continued*:**

5. **Aggressive, precise actions can reduce costs and remedial timeframes by an order of magnitude.**
    - Use the savings from optimizations and stopping what isn't working.
    - Take targeted, precise, aggressive actions that are known to be effective.

6. **Do more than agree. Get buy-in and investment in the outcomes that are worth achieving.**
    - This is not as hard as it sounds.
    - The key is understanding what the stakeholders need in order to make decisions, versus the arbitrary positions or wants that they may have.

Questions????

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Abbreviations / Acronyms

DoD - United States Department of Defense
CERCLA - Comprehensive Environmental Response, Compensation, and Liability Act
EPA - United States Environmental Protection Agency
CTC – Cost to Complete
OU – Operable Unit
RA-O – Remedial Action – Operation
ROD – Record of Decision
DPE – Dual Phase Extraction
MNA – Monitored Natural Attenuation
MiHPT – Membrane Interface Hydraulic Profiling Tool
SPT – Standard Penetration Test
DPT – Direct Push Technology
ERD – Enhanced Reductive Dechlorination