



Combining Source Area Treatment with Monitored Natural Attenuation – SWMU 1, NAS Pensacola

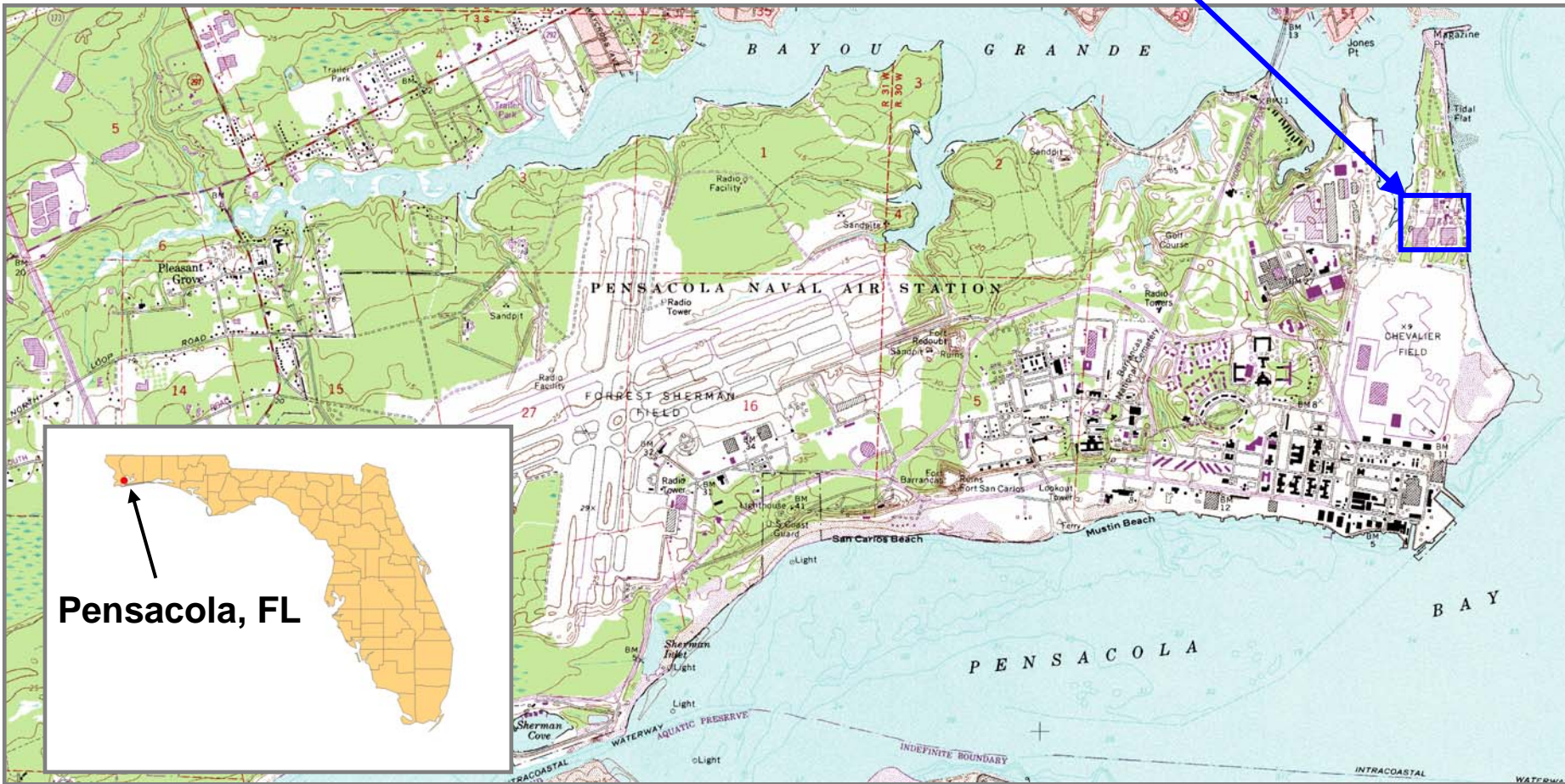
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NAS Pensacola, FL



SWMU 1, Waste Water Treatment Plant



Pensacola, FL

SWMU 1 - WWTP



- **WWTP received industrial and domestic wastewaters 1941-1971**
- **Electroplating and paint removal operations**
- **Pump & treat system operated 1986-1997**
 - **Shown ineffective for plume treatment**
- **Excavation/capping of sludge drying beds 1989**
- **RCRA Permit**
 - **Source Reduction**
 - **Monitored Natural Attenuation**





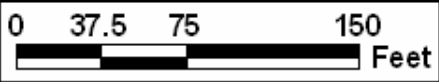
WWTP, NAS Pensacola

Capped Sludge Drying Beds

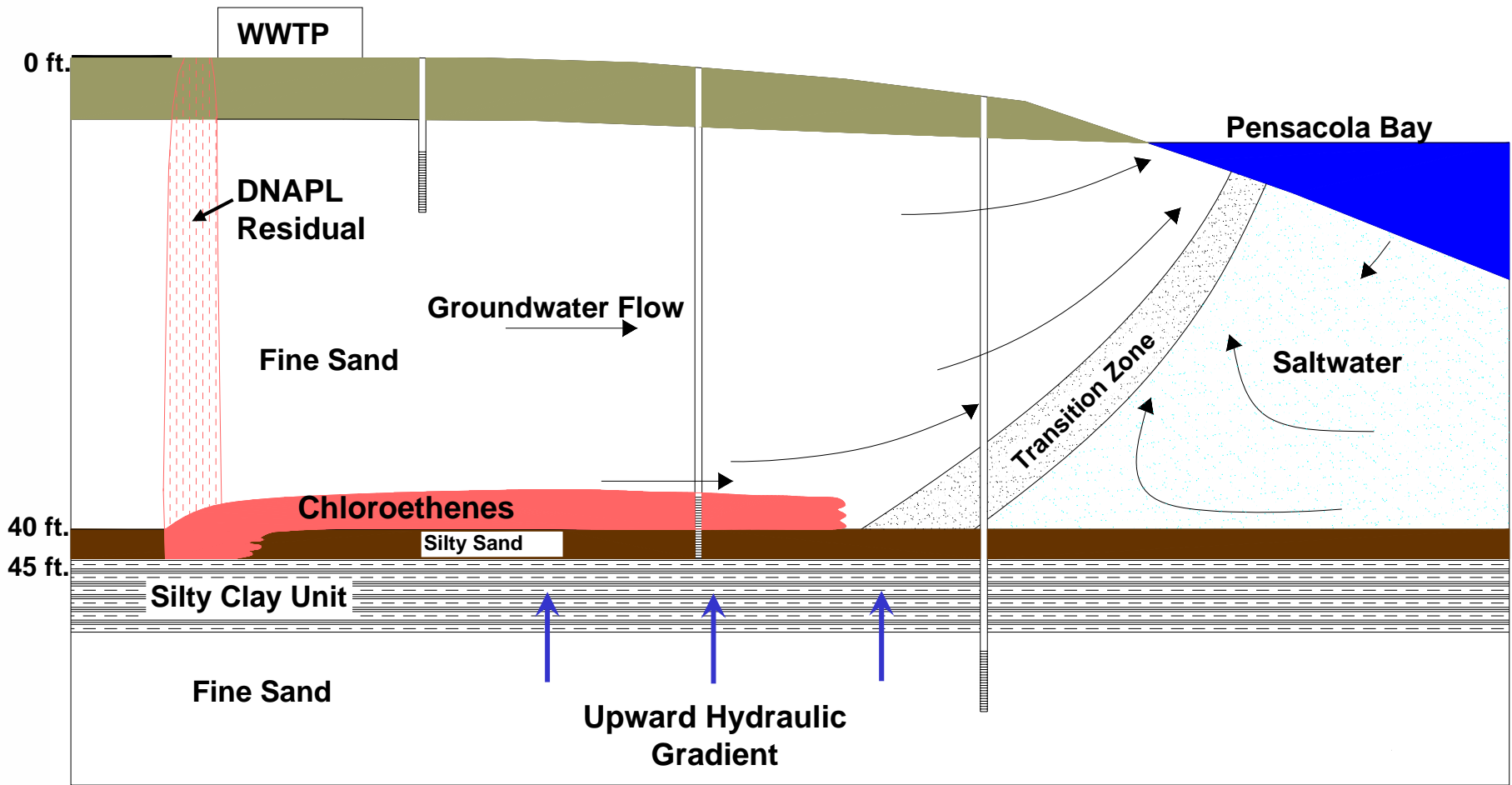
Pensacola Bay



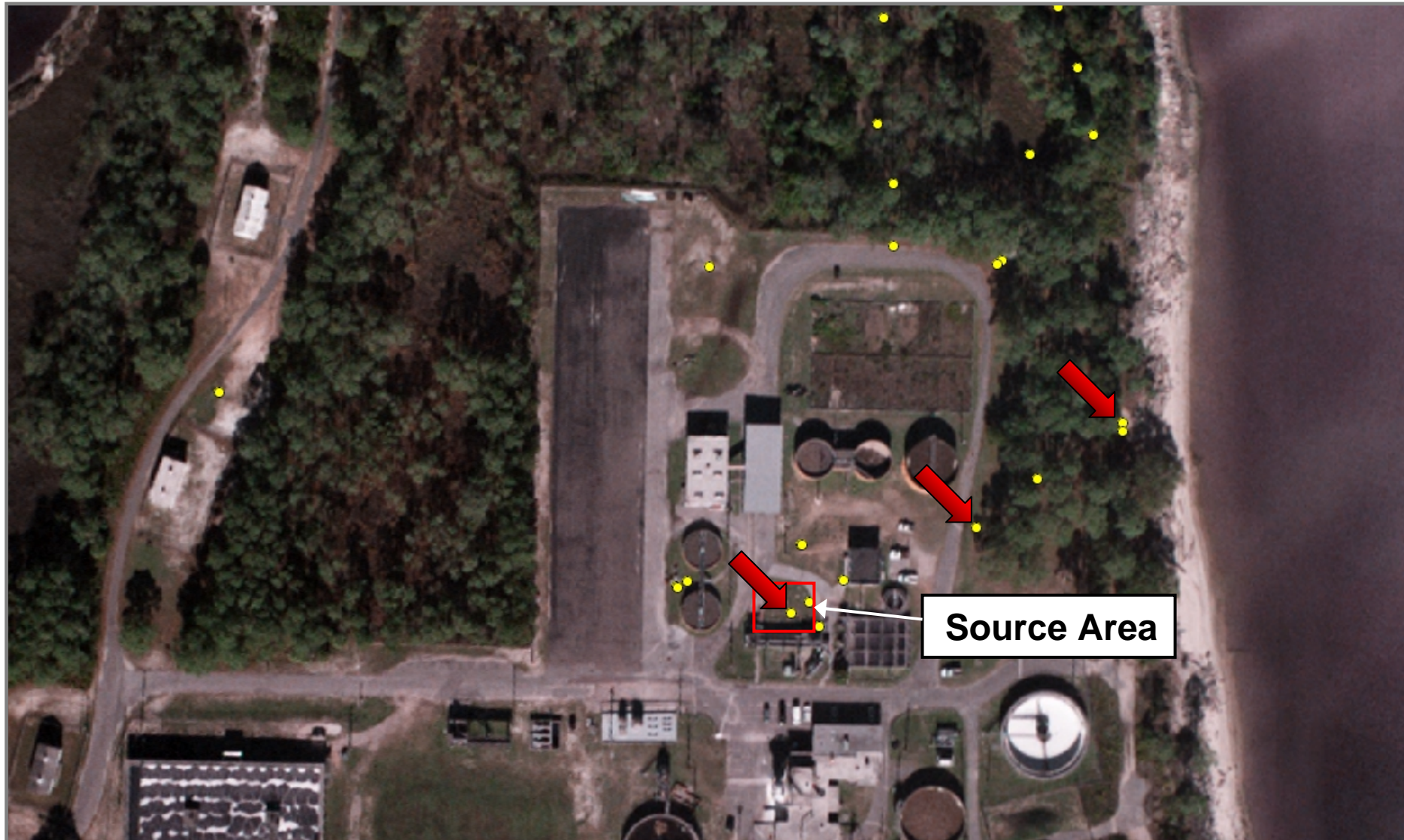
Chloroethene Plume



Conceptual Site Model

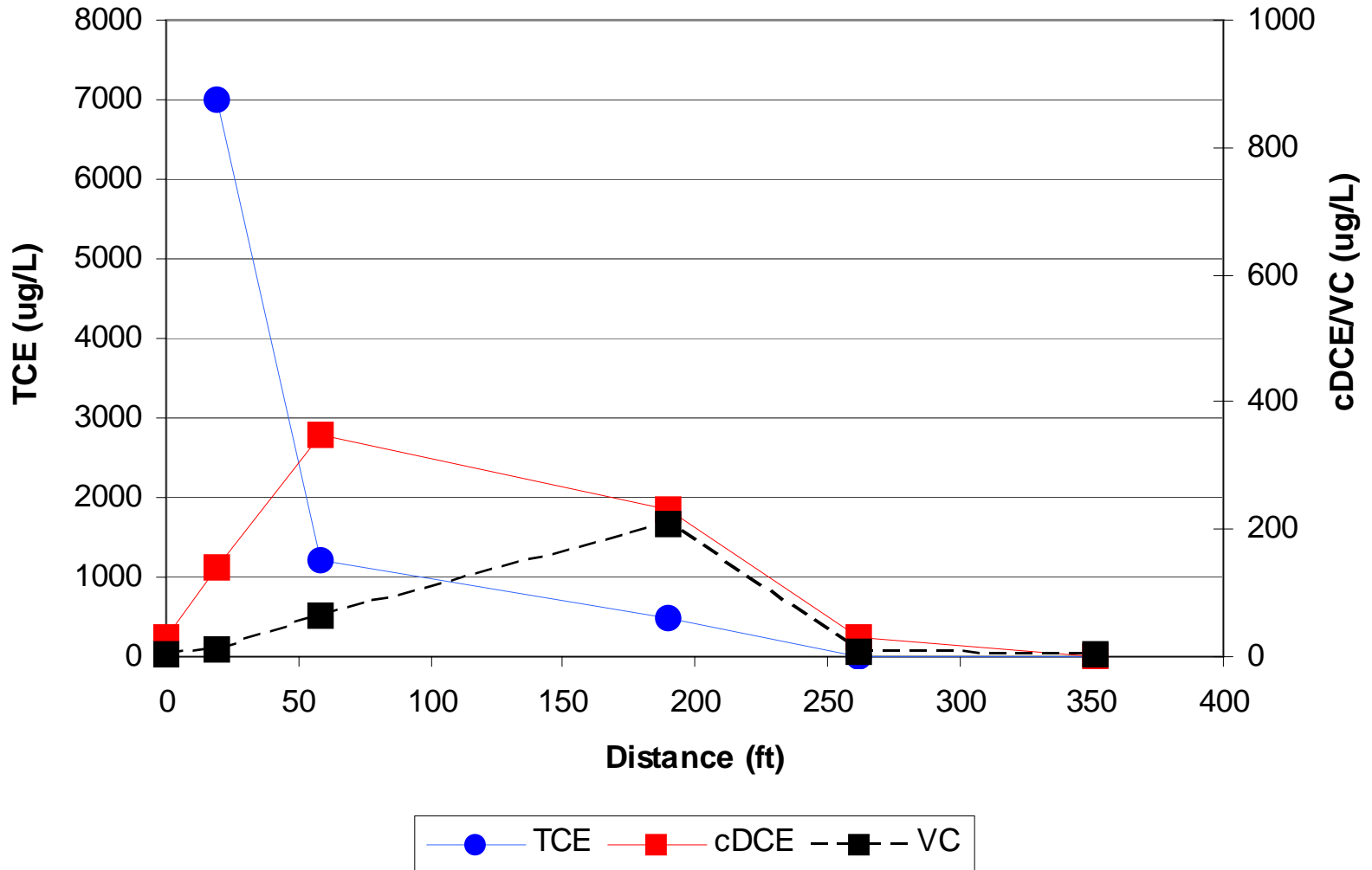


Chlorinated Solvent Plume



Source Area

Chlorinated Ethenes



Data from July 2005

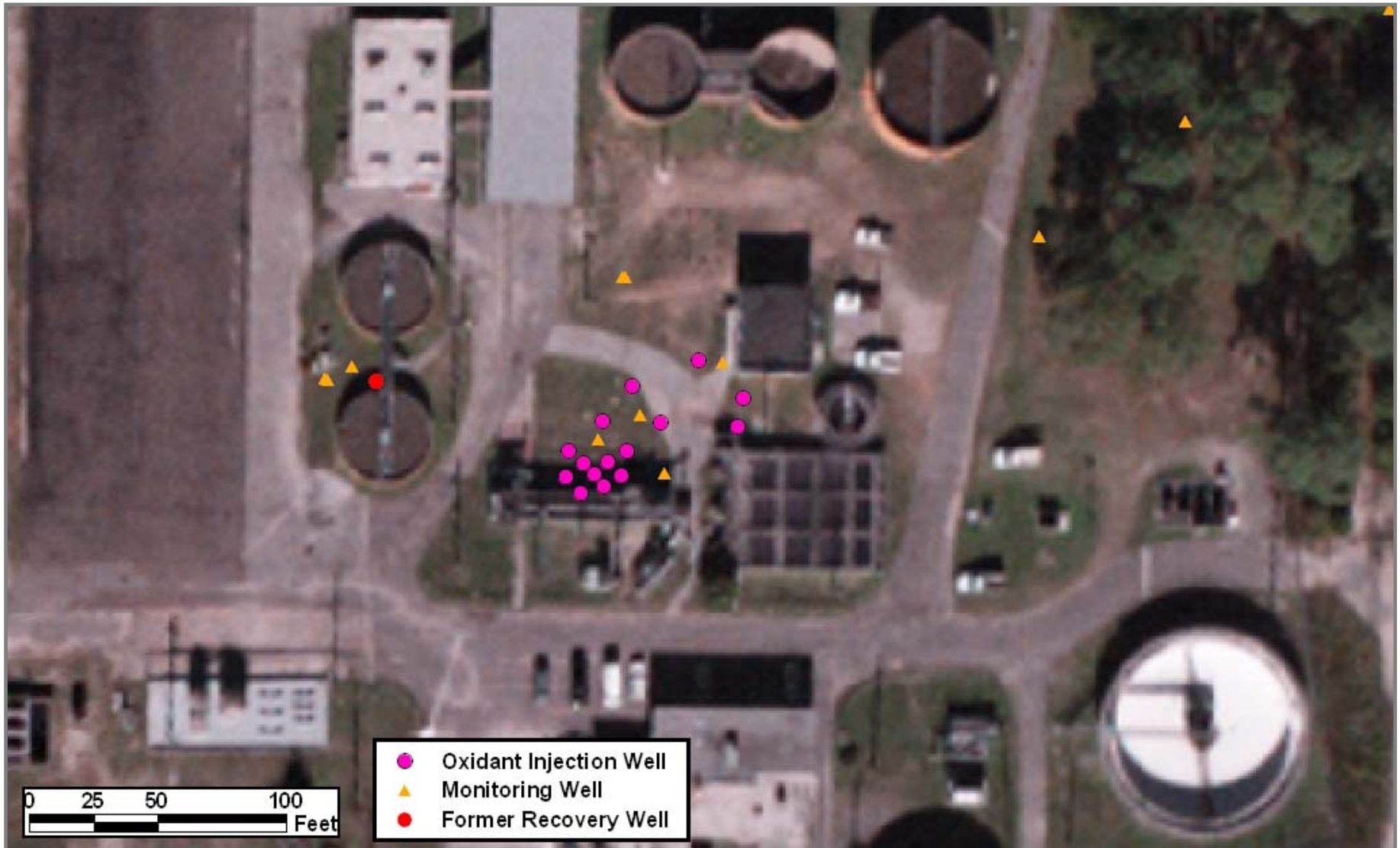
In Situ Chemical Oxidation



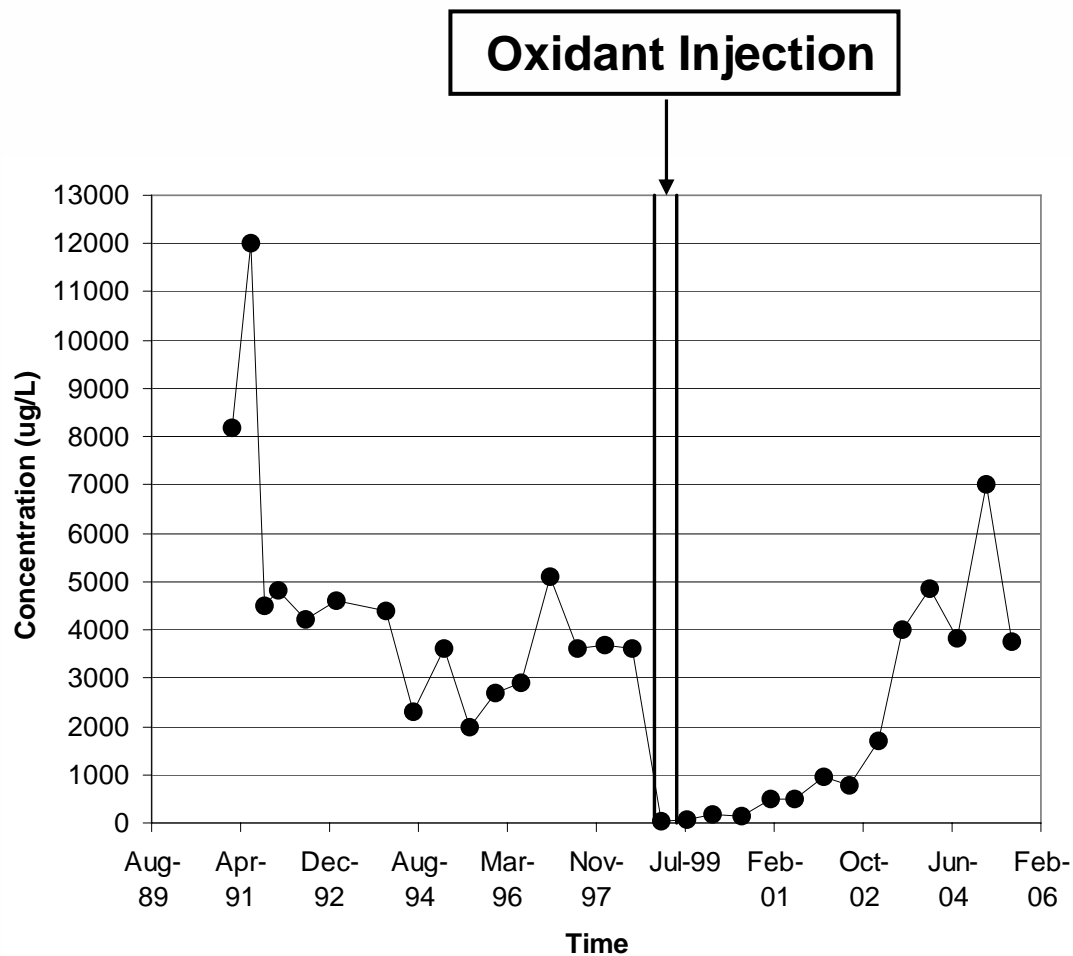
- ❑ Source reduction strategy
- ❑ Fenton's reagent
- ❑ Pressurized injection using permanent wells
- ❑ 35 - 40 ft depth interval
- ❑ Phase I – December 1998
 - 4,089 gallons 50% H_2O_2 solution
- ❑ Phase II – May 1999
 - 6,038 gallons 50% H_2O_2 solution



ISCO Injection Wells

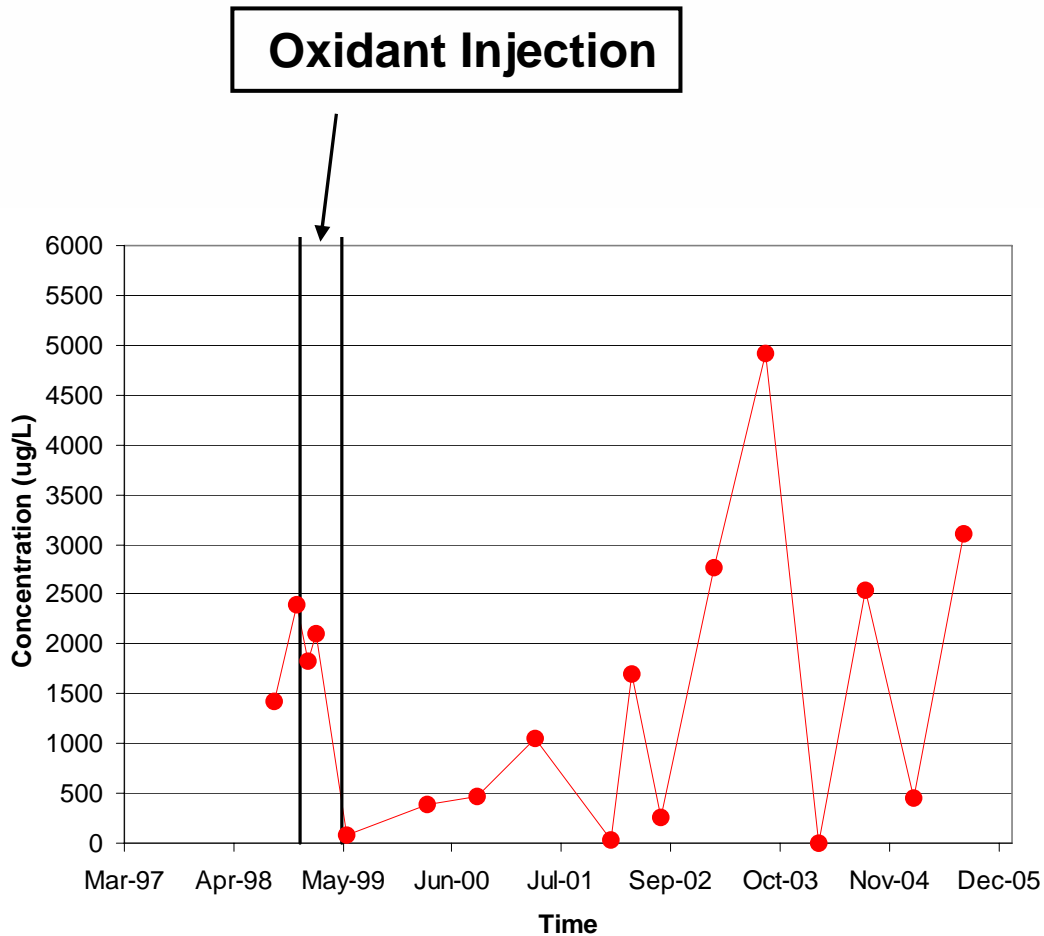


TCE Rebound in Source Area



GM-66

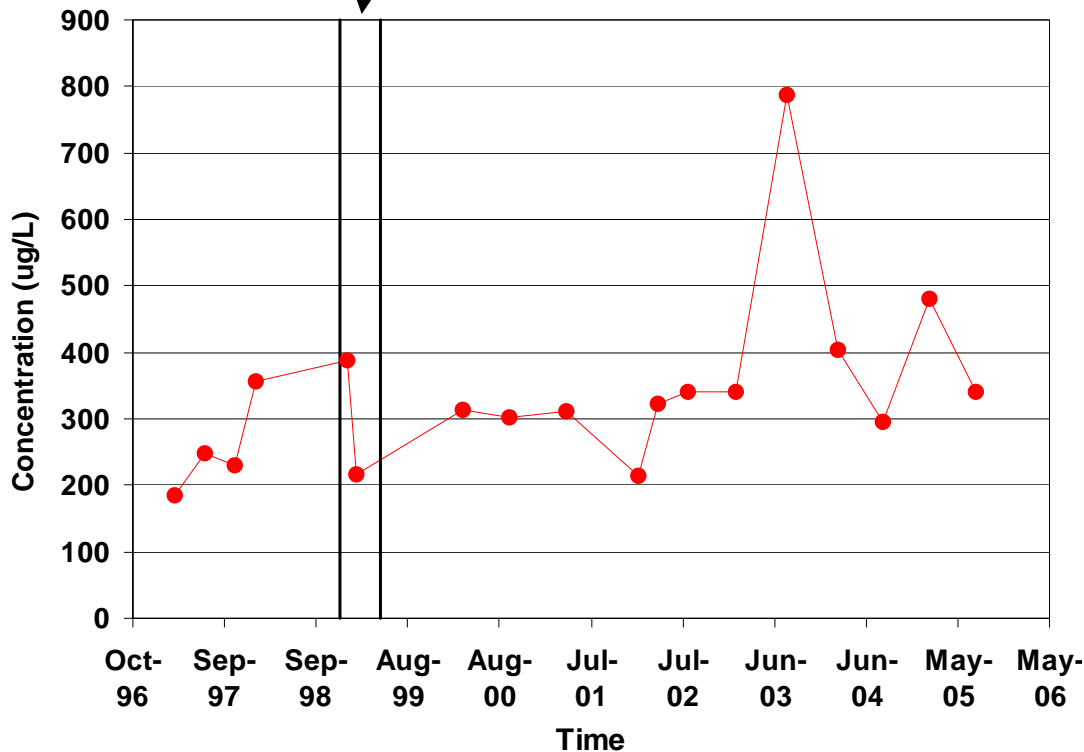
TCE Rebound (Cont.)



USGS-5

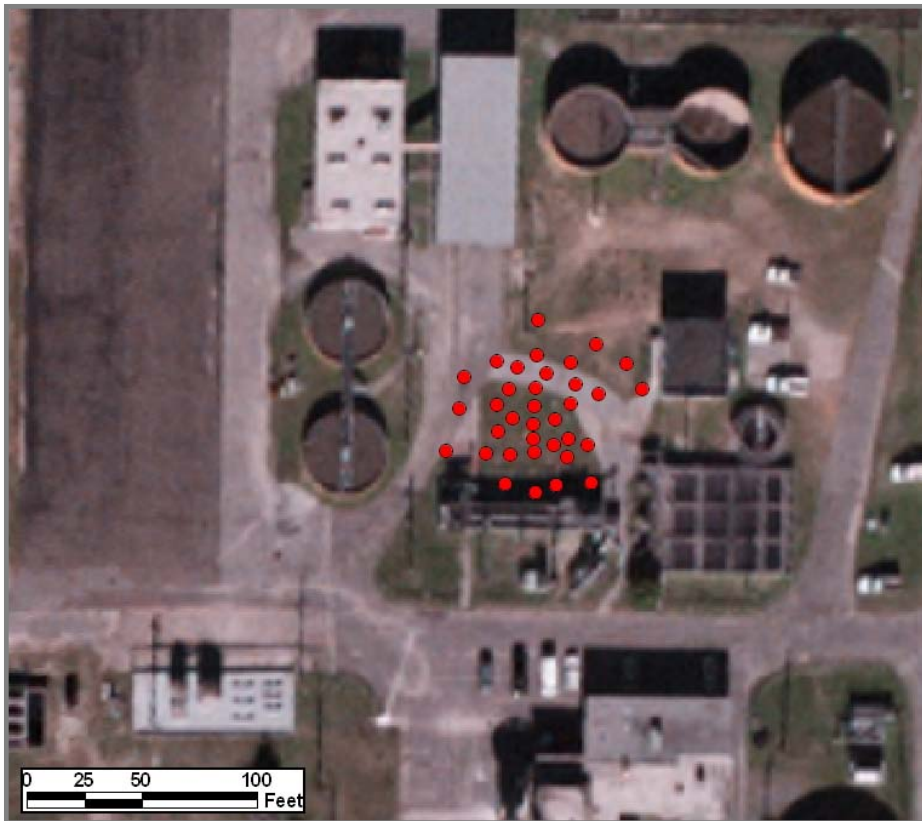
Downgradient Well - TCE

Oxidant Injection



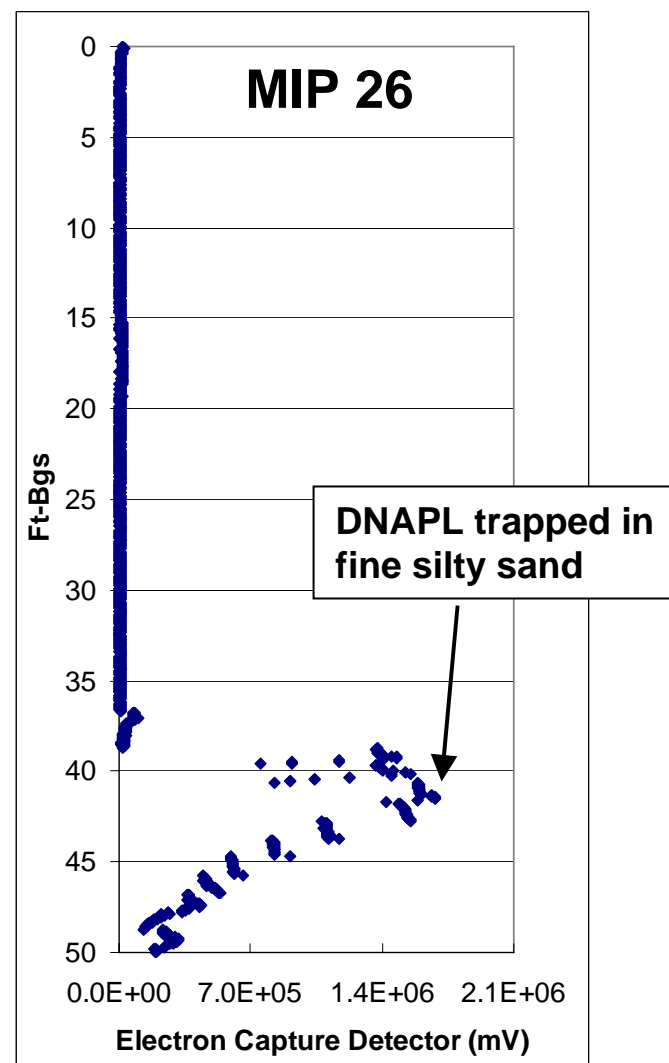
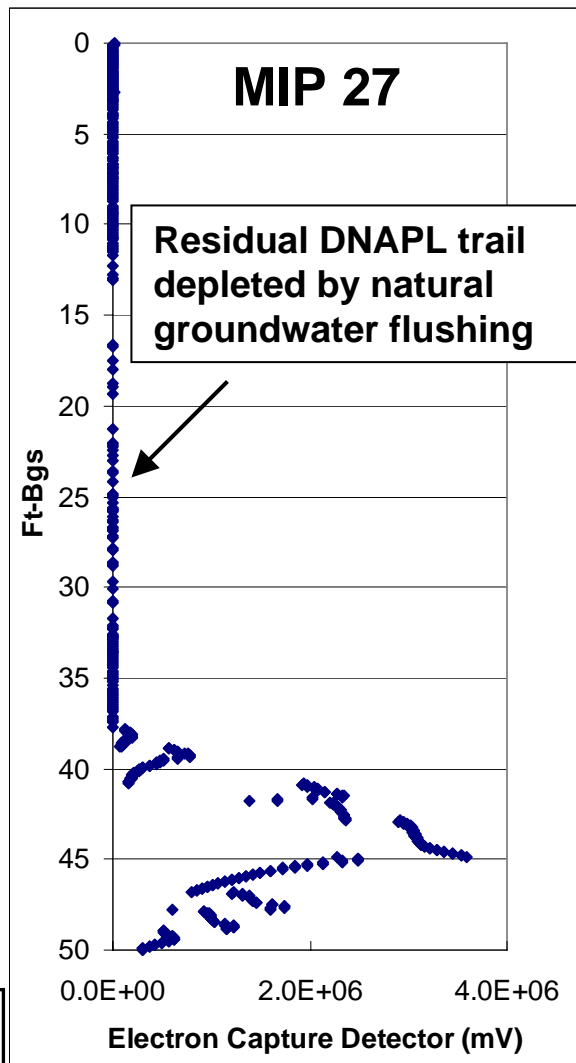
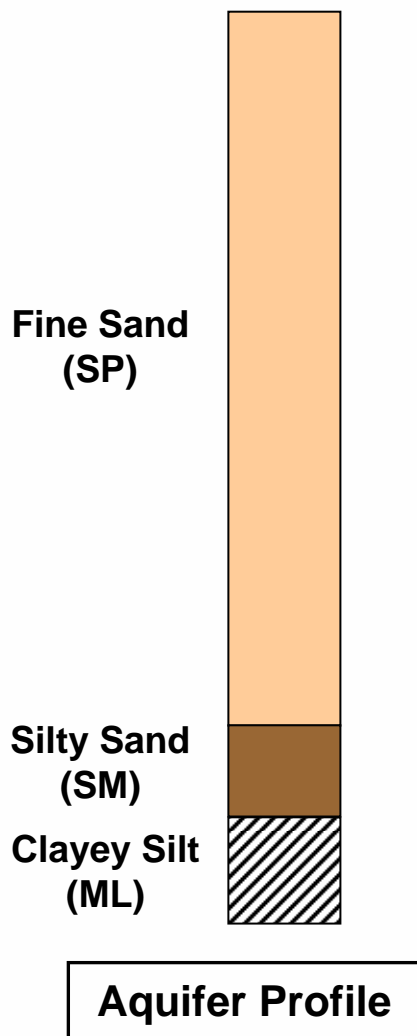
USGS-1
125 ft Downgradient

Post-ISCO MIP Investigation

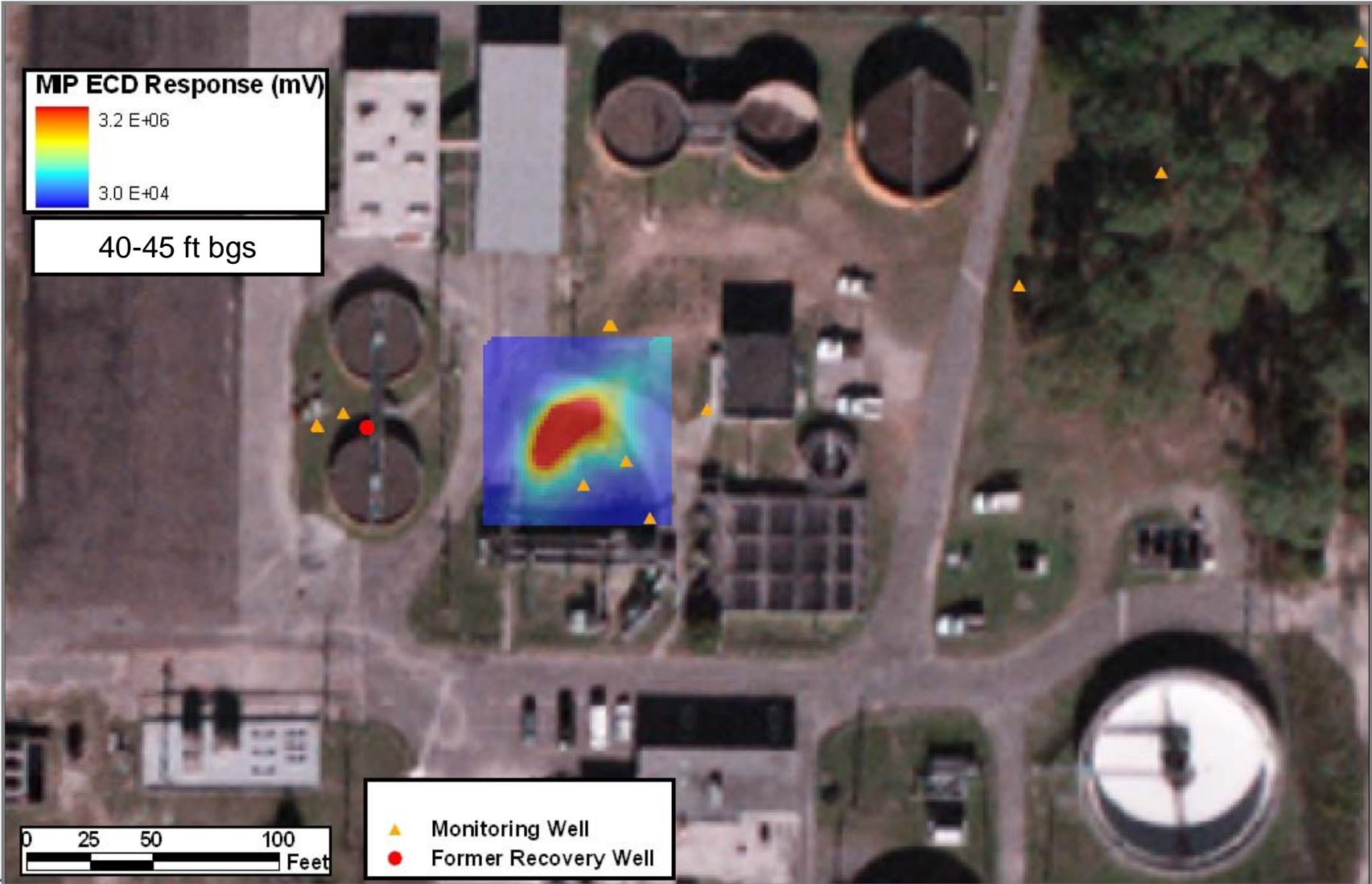


- Triad Approach
- 35 MIP locations in 7 days
- Defined lateral extent of DNAPL source area
- Detailed vertical logging (6-in. interval)
- Confirmation DPT groundwater sampling

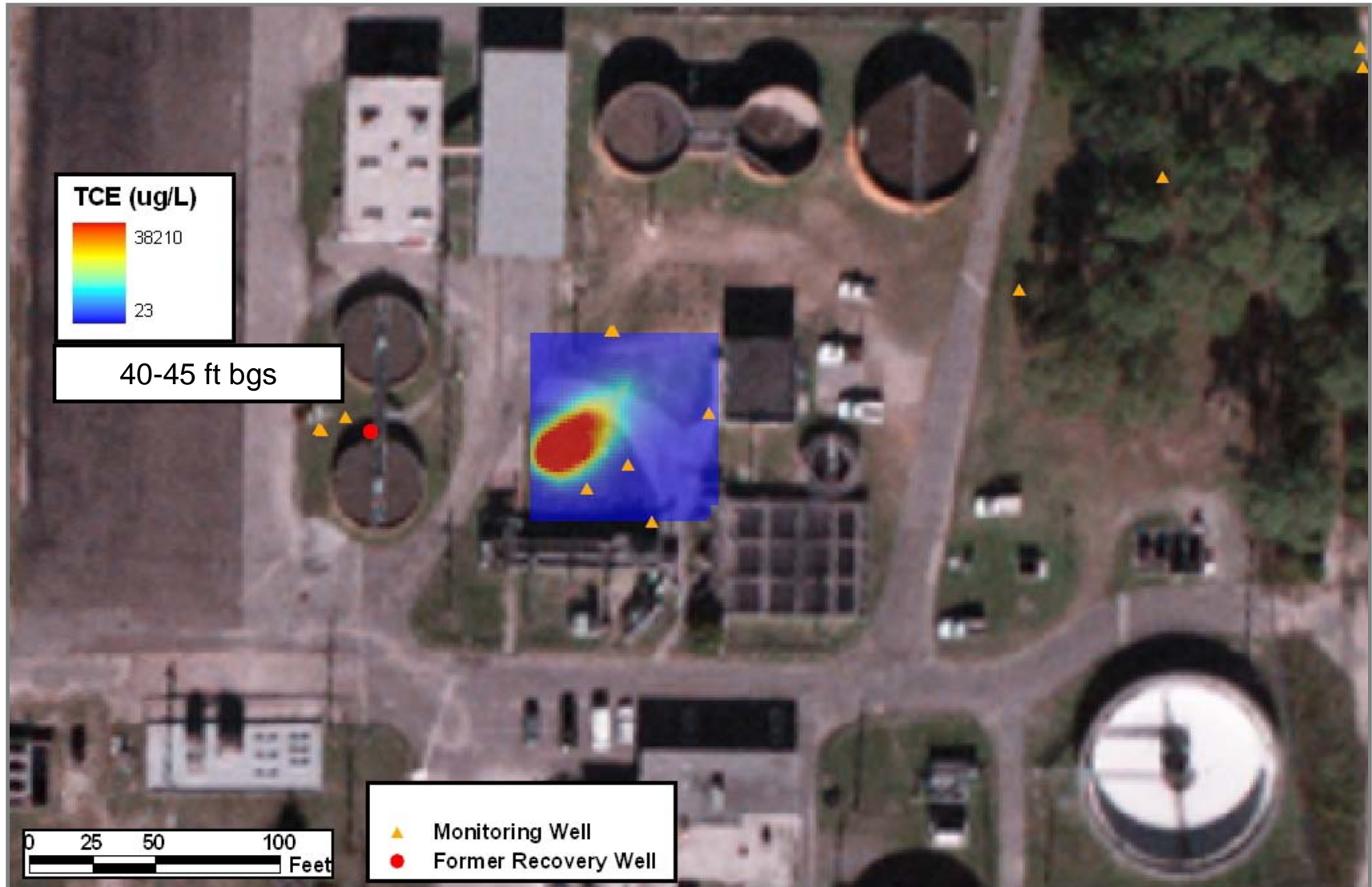
Typical MIP ECD Response



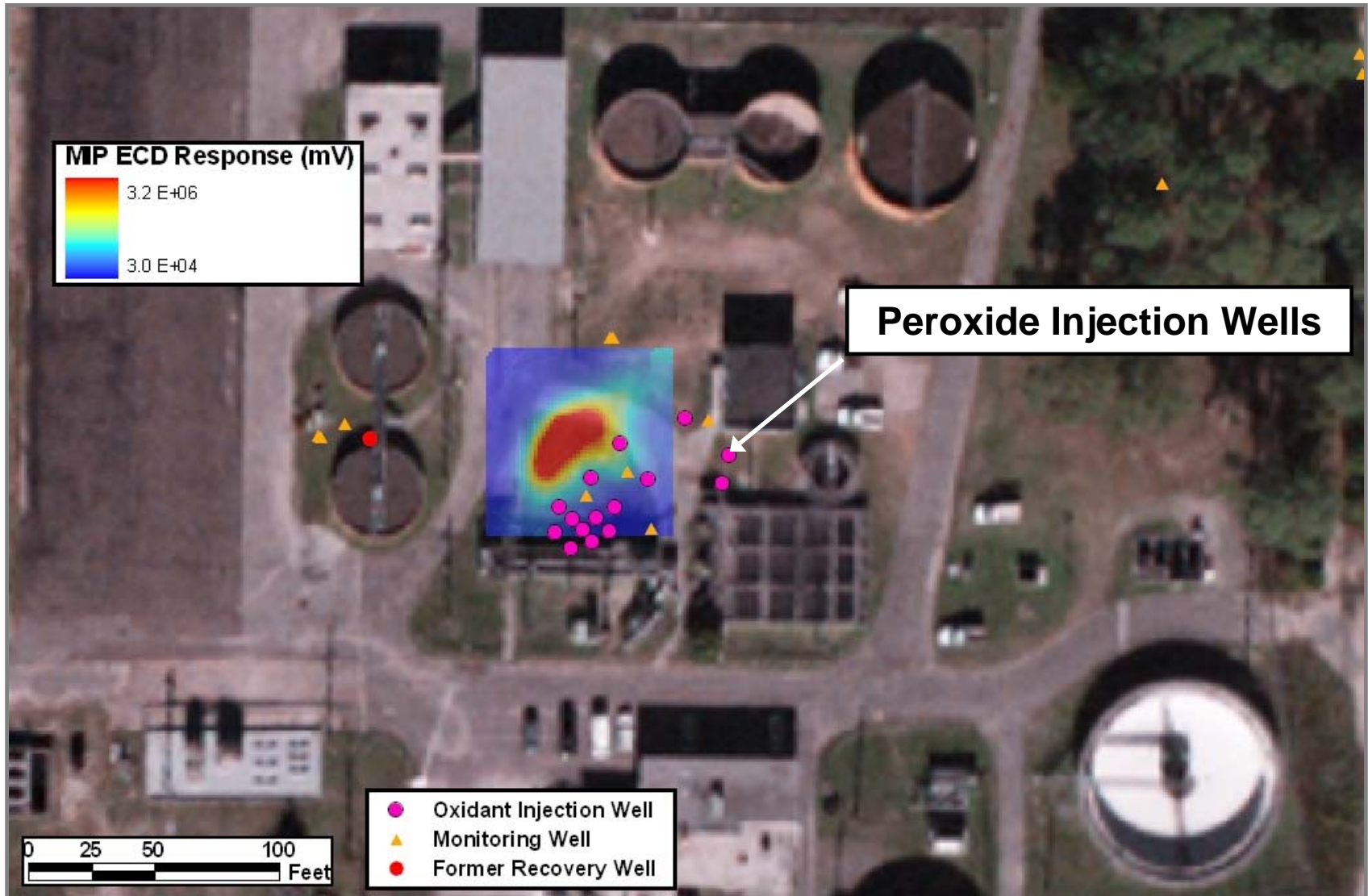
MIP Data Evaluation – DNAPL Extent



Confirmation GW Sampling - TCE



Partial DNAPL Treatment



Conclusions



- **Conditions favorable for source zone treatment at both sites**
 - Shallow, permeable aquifer
 - Effective natural attenuation
- **Factors Limiting ISCO Success at NAS Pensacola**
 - Upward hydraulic gradient
 - Enhanced mass flux from low permeability unit
 - ISCO treatment interval too shallow
 - Incomplete DNAPL source characterization
- **Path Forward at NAS Pensacola**
 - Source area treatment using bioremediation
 - Shorten time of remediation

Lessons Learned



- ❑ Evaluate potential benefits of source reduction vs. additional costs and risks**
- ❑ Manage expectations of stakeholders**
 - Establish realistic RAOs
- ❑ Small, shallow sources in permeable material**
 - Treatment or excavation preferred remedy
- ❑ Large source areas, especially low permeability and/or heterogeneous formations**
 - Consider risk management strategies, including containment and/or plume treatment

Lessons Learned (Cont.)



- ❑ **In situ treatment train effective DNAPL management strategy**
 - **Single technology rarely able to achieve cleanup objectives**
- ❑ **Develop Target Treatment Zones (TTZs) to focus active treatment**
 - **Most “Bang for the Buck\$\$” in source area**
 - **Rely on passive treatment and/or MNA for dissolved-phase plume**

Questions?



Naval Air Station Pensacola, FL