Lead Shot Recovery & Recycling From A Wetland

2 Case Studies

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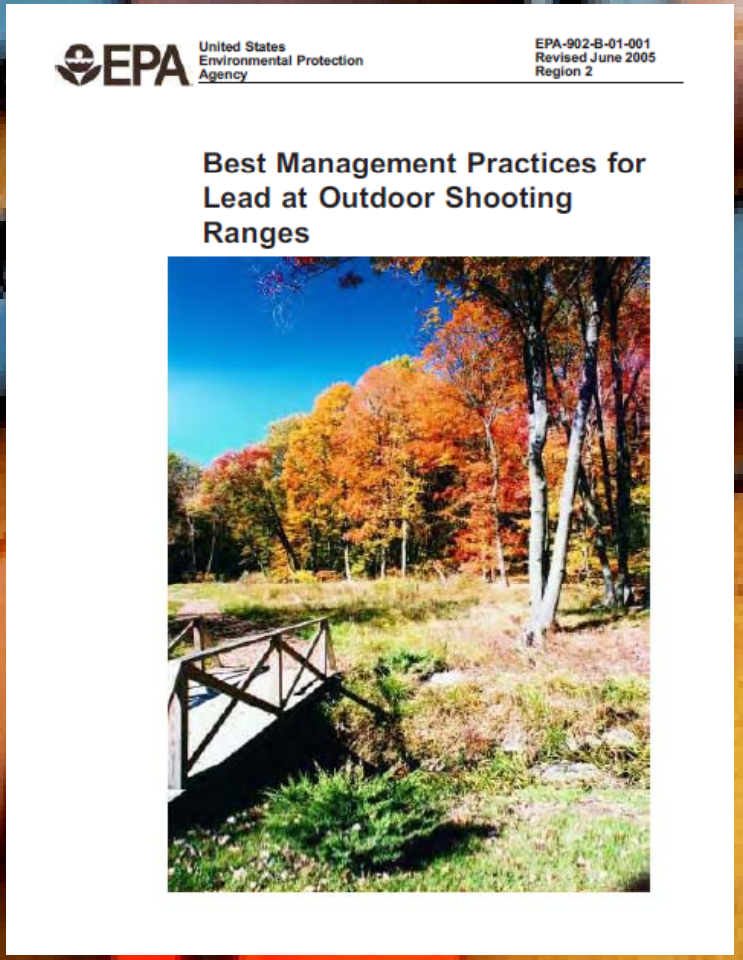
A Little History

- Why do/did so many [redacted] shoot over wetlands?
  - Used to be "swamps"
  - Little perceived land value [redacted]se
- Many still do
  - Most that do have switched over to steel shot

Shooting Range BMPs

- EPA Guidelines for Maintenance/Stewardship
  - Periodic Shot/Lead Recovery
  - Many View as Asset
  - Improvements/BMPs
    - Shot Curtains
    - E&SC Improvements
    - Target Debris Removal



Closure vs. Maintenance

Closure

- Clean it up to published standards, typically 400 ppm (res) or 800-1400 ppm (ind)
- Excavate/Stabilize/Dispose of soils - $$$
  - TCLP – treat with various commercial products
    - TerraBond
    - EnviroBlend
    - TRAPPS

Closure vs. Maintenance

Maintenance

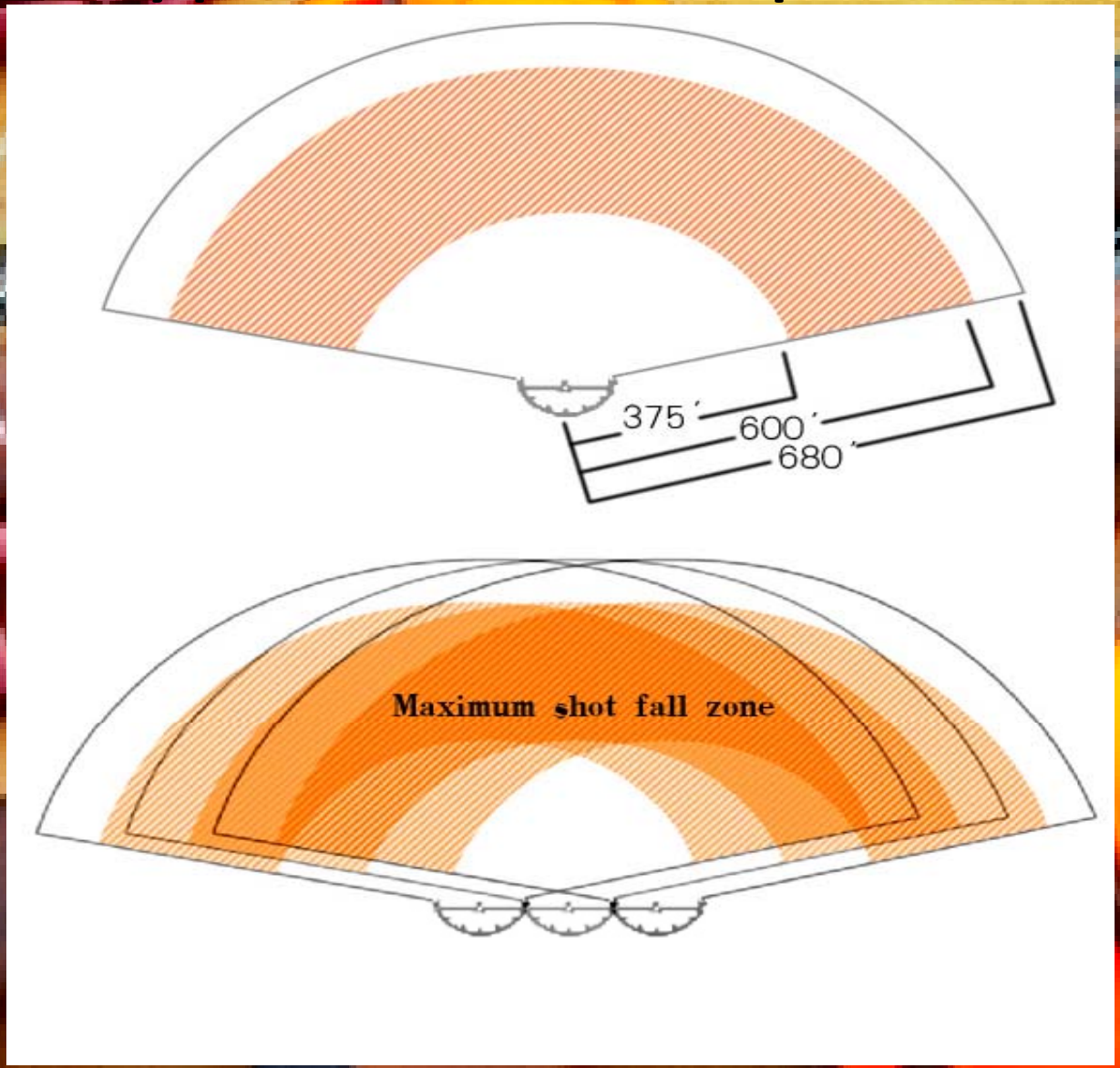
- Shot Recovery
- Soil Amendment to reduce leachability
- No “clean-up” standard
- Terrain Makes a difference
  - Rocky
  - Swampy
  - Heavily Wooded

Shot Dynamics

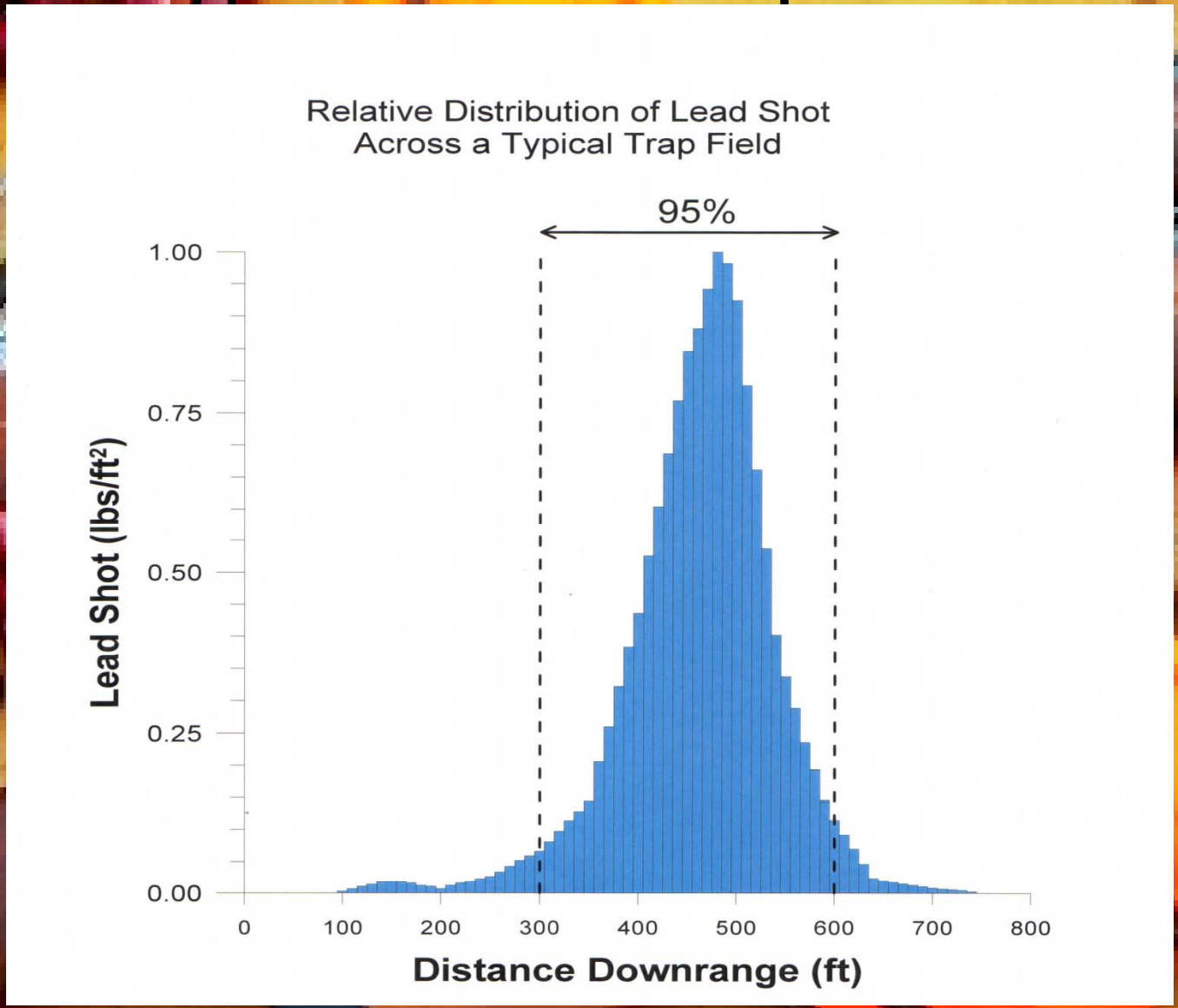
What Makes it so Challenging?

- Shot Dispersal Patterns
  - 95% from 300 ft to 600 ft from shooting stations
  - Usually in top 6-inches to 1-ft of soil
  - Recovery usually focuses on "sweet spot" vs. remediation is "dig it all up".
  - Big Volume difference = big $$$ difference
- Terrain

Typical Shot Dispersal



Typical Shot Dispersal



Terrain Examples

Shot fall zone examples (Great!)

Terrain Examples

Shot fall zone examples (Bad!)

Terrain Examples

Shot fall zone examples (Bad!)

Site 1 – Northern Ohio

- Shooting Since 70's
- Shot into 4 acre wetland
- Closure
  - Lower Lake Level
  - Excavate 12,000 CY
  - Separate Shot
  - Treat (if needed) and dispose
  - 400 mg/kg total lead cleanup standard

Site 1 – Approach

- Excavated from Mats
- Wet separation system/recycled water
- Lined impoundment
- Geotube for sediment
- All Sediment remained on site
- 240,000 lbs of shot recovered ~ $200,000

Site 1 - Approach

W[illegible]ds condition upon arrival

Beginning mat road installation

Site 1 - Approach

Mat road installed (from shore)

Mat road installed (from lake)

Site 1 - Approach

Excavation conditions (wet/soft)

Aerial view of site & mat road

Site 1 - Approach

Reverse rifle plant

Lined recirculation pond

Site 1 - Approach

Reverse rifle plant in operation

Spray bar on drum

Site 1 - Approach

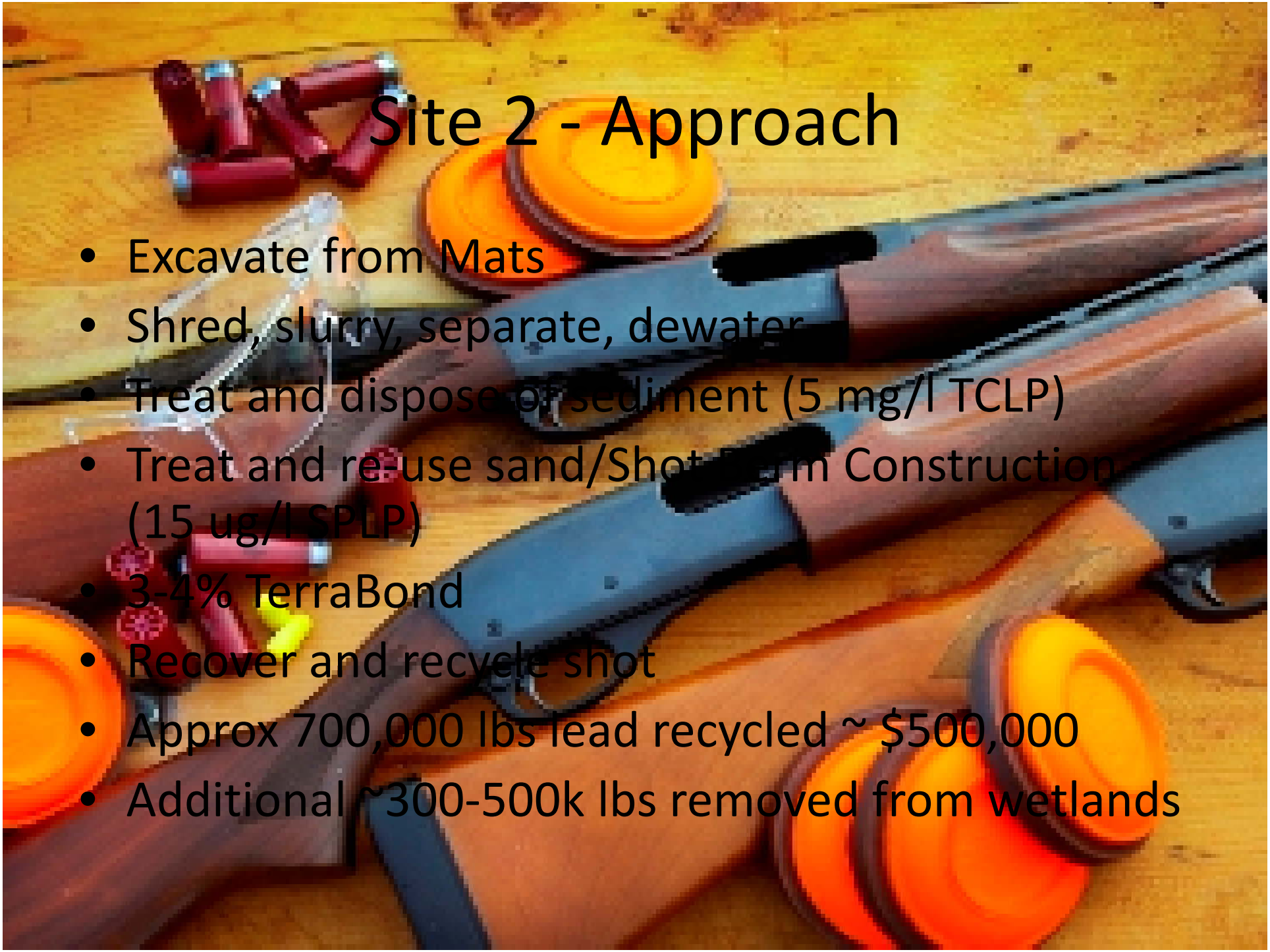
Spot checking removal efficiency

Finished product, ready to ship

Site 2 – SW Florida

- Shooting Since 40's/Switched to steel 10+yrs ago
- Shot into 14-acre wetland
- BMP/Closure Hybrid (Club will keep shooting)
  - Berm around and dewater wetland
  - Excavate 40,000 CY
  - Slurry, screen, dewater, "polish"
  - Treat residues and dispose or re-use as appropriate
  - Keep it wet or try to dry it?

Site 2 - Approach



Site 2 - Approach

- Excavate from Mats
- Shred, slurry, separate, dewater
- Treat and dispose of sediment (5 mg/l TCLP)
- Treat and re-use sand/Shot [illegible]m Construction (15 ug/l SPLP)
- 3-4% TerraBond
- Recover and recycle shot
- Approx 700,000 lbs lead recycled ~ $500,000
- Additional ~300-500k lbs removed from wetlands

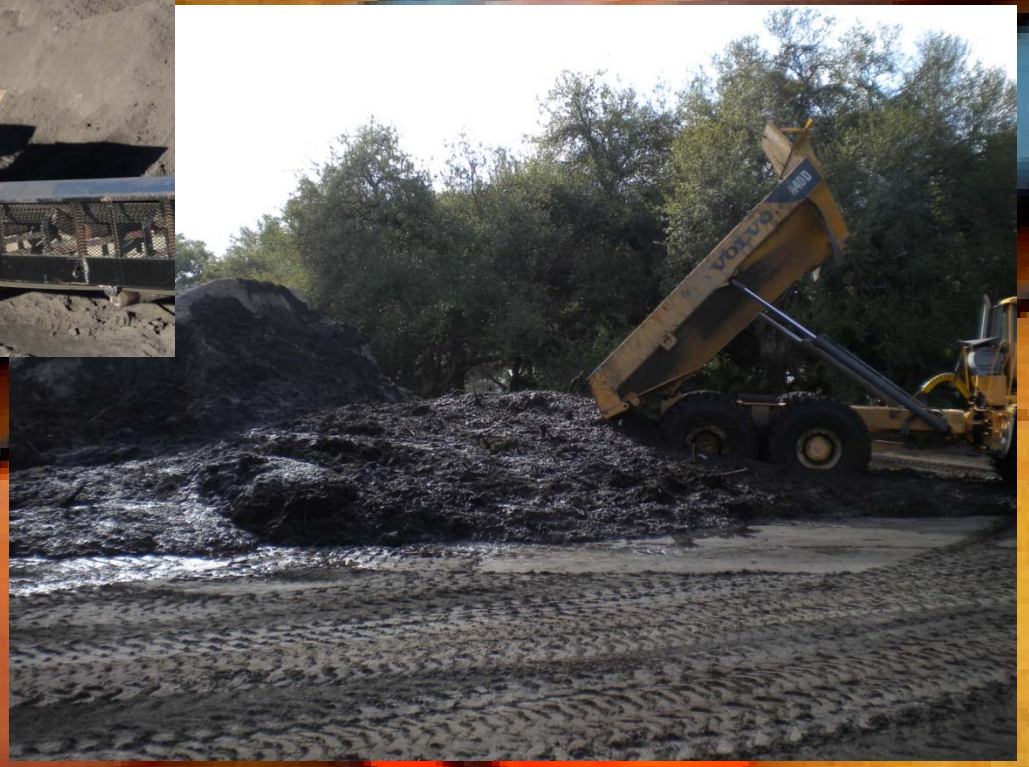
Site 2 - Approach

Site 2 - Approach

Excavation from mats

Site 2 - Approach

Loading shredder at front of system



Consistency of some material

Site 2 - Approach

1-inch wet shaker

¼ inch wet shaker

Site 2 - Approach

esh (1.75 mm) screen for shot

Sand screen

Shot Screening

Shot Screening

Sand Screening

Sand Screening

Site 2 - Approach

#[redacted] (shot) screen discharge

Sand screen discharge

Site 2 - Approach

A[illegible]paration of shot from similar mesh-size debris

Bagged shot ready for recycling

Conclusions

- Difficult sites, can be expensive, but both remediation goals and recovery are feasible
- Dewatering and peat present challenges that require innovative thinking
- Make "wet or dry" decision early
- Think "out of the box" on equipment and it's application/capabilities.