A dynamic splash of clear blue water against a white background, with droplets and ripples visible. The water flows from the left side towards the right, creating a sense of movement and freshness.

**WEDA 33rd & 44th TAMU
AUGUST 25-28, 2013**

**The Future of Remediation at Contaminated Sediment Sites -
How Dredge Companies are Evolving to
Meet the Current Challenge**

BRENNAN





Introduction

The EPA generally recognizes three major approaches for sediment remediation:

- Monitored Natural Recovery (MNR)
- In-situ Capping
- Dredging, with Treatment and/or Disposal

The preferred remedy at large complex sites is often a combination of alternatives as each approach has its limitations. In-situ treatments have the potential for increased effectiveness and significantly reduced costs over conventional approaches.



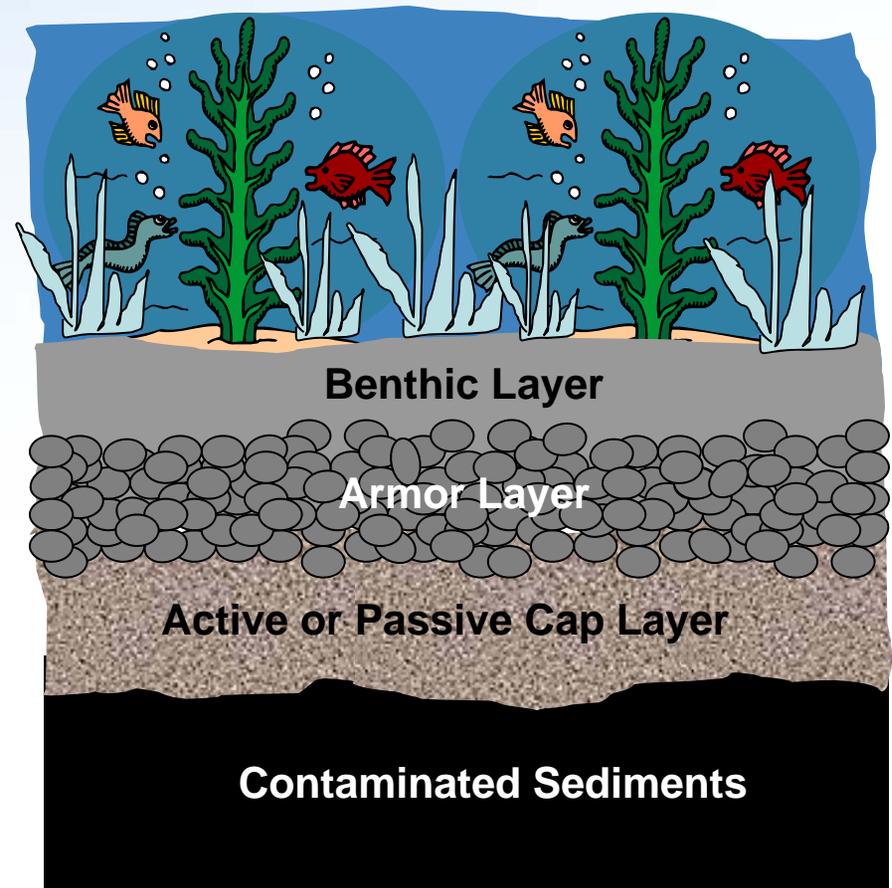
BRENNAN

The logo for Sevenson Environmental Services, Inc., featuring a stylized "S" symbol followed by the text "Sevenson Environmental Services, Inc." in a sans-serif font.

Sevenson
Environmental
Services, Inc.

Why are We Interested in “In Situ” Capping?

- Recent advancements in capping technology
- Immediate risk reduction
- Can be less expensive than dredging
- Minimal resuspension of contaminated sediment
- Can take less time to implement than other remedies





Summary of Sediment Capping Technologies

Types of Caps

Conventional Cap

- Sand Cap
- Natural Material Cap

Armored Cap

- Cap with armor Layer of stones or rip-rap to provide protection in high velocity environments

Composite Caps

- Multi-layers
- Geotextile (Reactive Core Mat)
- Aqua Blok

Sediment Capping Technologies

- **Conventional Capping** (clean sand/sediment)
- **Active Capping**
 - Carbon (organics, mercury)
 - Oleophilic Clay (NAPL, oils)
 - Apatite / zeolite (metals)
 - Zero-valent iron
 - Microbial activity enhancement
- **Cap Armor Layer**
 - Top layer of cap
 - Protects against river current erosive forces, propeller wash, ice scouring
- **Enhanced Natural Recovery**
 - Sand (thin layer)
 - Amendments can be added





Innovative Capping Techniques

This presentation evaluates currently available innovative in-situ capping technologies developed (and utilized) by J.F. Brennan Co., Inc. and Severson Environmental Services, Inc. to place various types of caps.

- *Severson Environmental Services, Inc., 2749 Lockport Road Niagara Falls, NY 14305*
- *J.F. Brennan Co., Inc., 820 Bainbridge Street, LaCrosse, WI 54603 USA*

BRENNAN





**Sevenson
Environmental
Services, Inc.**

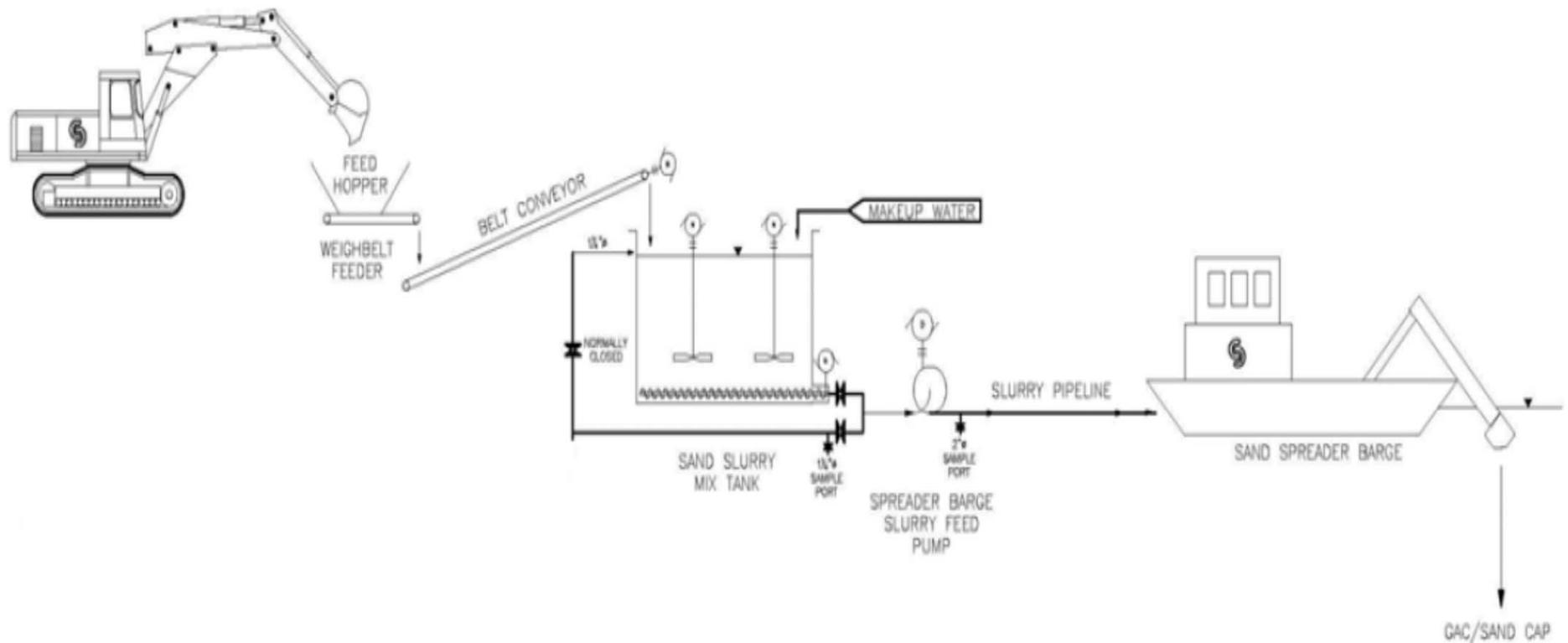
- *Excavation and earthwork*
- *HTRW materials handling, processing and treatment*
- *Sediment remediation*
- *Dredging, dewatering and volume reduction*
- *Innovative and traditional steel sheeting systems*
- *Sludge solidification and soils stabilization*
- *Slurry wall and trench construction*
- *Temporary and mobile water treatment systems*
- *Collection, recovery and treatment systems construction*
- *Chemical treatment/heavy metals fixation*
- *Facilities decontamination and demolition*
- *Constructibility review and design phase consulting*



2749 Lockport Rd. • Niagara Falls, NY 14305 • 716-284-0431

www.sevenson.com

Sevenson Capping System (Patent Pending)





Land Based Slurry System

The land based slurry system consists of;

- A loading hopper and weigh belt conveyor
- Slurry mix tank where sand, water, and/or other capping materials (i.e. activated carbon, etc.) are combined
- Dredge style booster pump, with a HDPE pipeline that connects the slurry system to the spreader barge.



Barge Mounted Spreader System

The barge mounted spreader system consists of;

- A slurry water makeup pump for injection of sand into the sand slurry tank prior to distribution into the spreader head (inclined or submerged)
- A sophisticated computer control system with spreader barge control software; referred herein collectively as the “controller”. The controller is linked with a global positioning system (GPS), a nuclear density meter, and a flow meter.

SHORE BASED SLURRY SYSTEM COMPONENTS



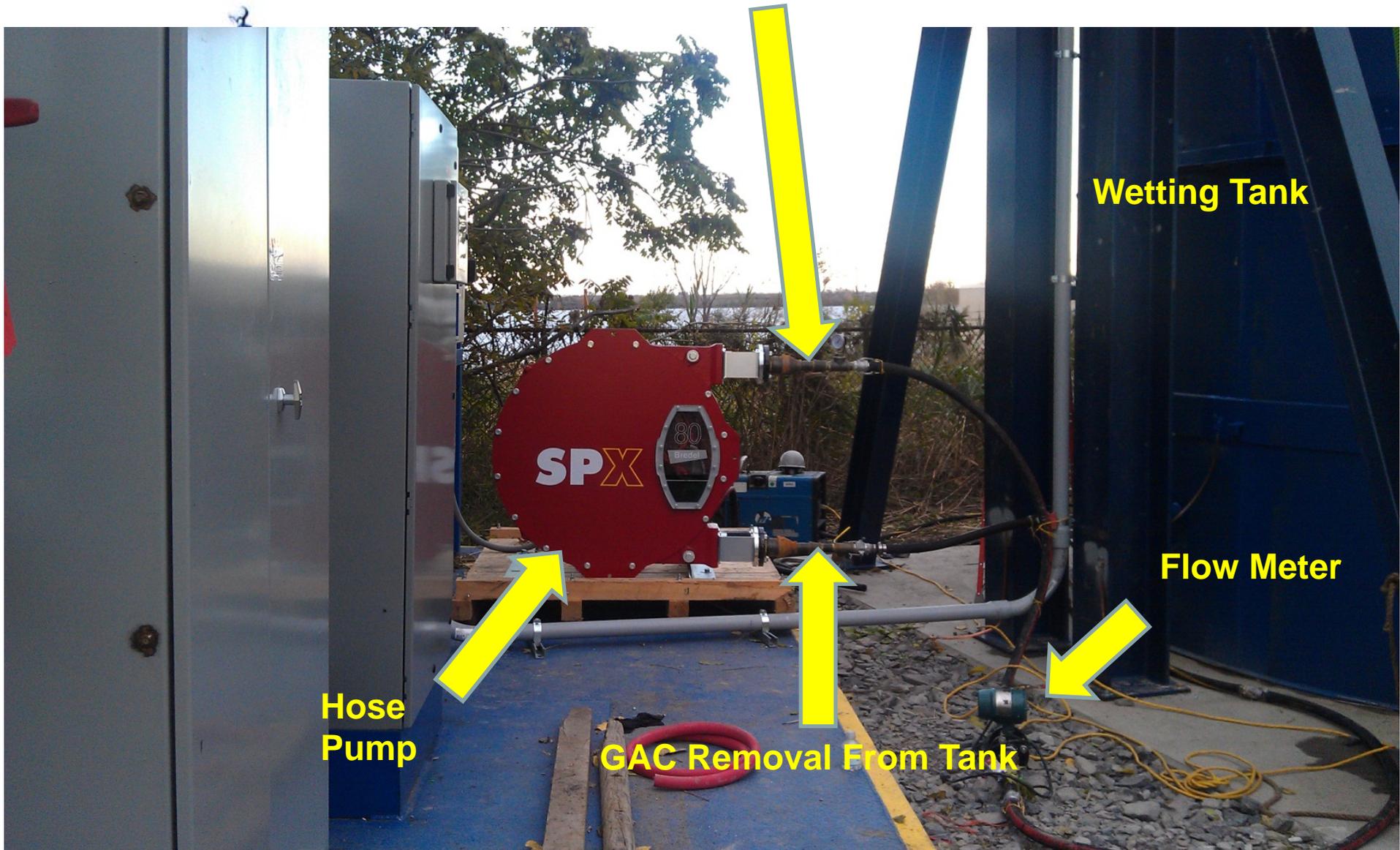






 Sevenson
Environmental
Services, Inc.

Slurry Transfer to Capping Barge



Hose Pump

SPX

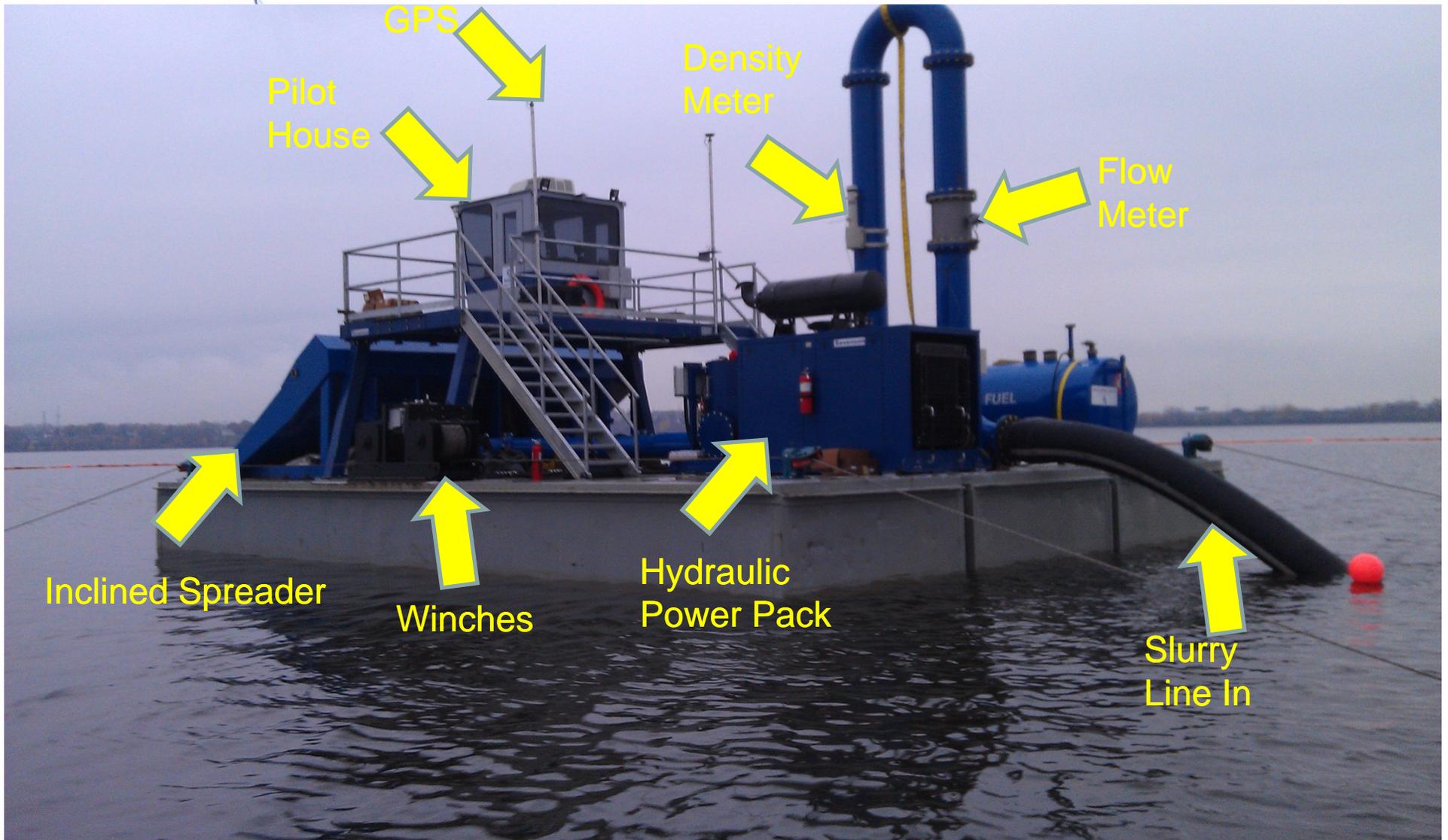
80
Bredal

Wetting Tank

Flow Meter

GAC Removal From Tank

SLURRY BARGE





Pilot House Electronics Setup

Screen Showing
Horizontal Position and
Track Lines

Screen Showing Left Right
Indicators, Heading, Cap
Thickness, CY/HR, Winch Speeds,
Travel Speed, Slurry Density,
Slurry Flow Rate



Past (and Current) Experience Remediation Capping Projects

- **Fox River Phase I Hot Spot Removal (Wisconsin)**
- **Silver Lake (Massachusetts)**
- **Onondaga Lake (New York)**
- **Jersey City SA7 (New Jersey)**
- **Confidential Client (Louisiana)**

2 Companies/ 3 Components



Contaminated Sediment Remediation





Past Experience Remediation Capping Projects

Capped over 900 acres to date

- **Fox River OU2-5 and OU1 Remediation Projects - EPA**
- **River Raisin Remediation Project - EPA**
- **Waukegan Harbor Remediation Project - EPA**
- **GLNPO – Region 5 EPA Projects**
 - **East Branch Grand Calumet River Remediation/Restoration Project**
 - **West Branch Grand Calumet River Remediation/Restoration Project**
- **Ottawa River Remediation Project**
- **Ashtabula River Remediation Projects - Phases I and II**
- **Alcoa – GAC Infusion Pilot Project**



BRENNAN



Capping Typical Project Challenges

- **Multiple covers and gravel armor specs**
- **Accurately spread thin layer of sand & gravel over very soft sediments**
- **Limit the amount of expensive material used**
- **When traditional Methods can not be applied successfully:**
 - **Shallowness of Fox River, Wisconsin**
 - **Range of depth from 2' to 15'**
 - **Limited access along shore – no material barge access**
 - **Shallow water column does not create velocity reduction**



In-situ Capping and Sand Covers

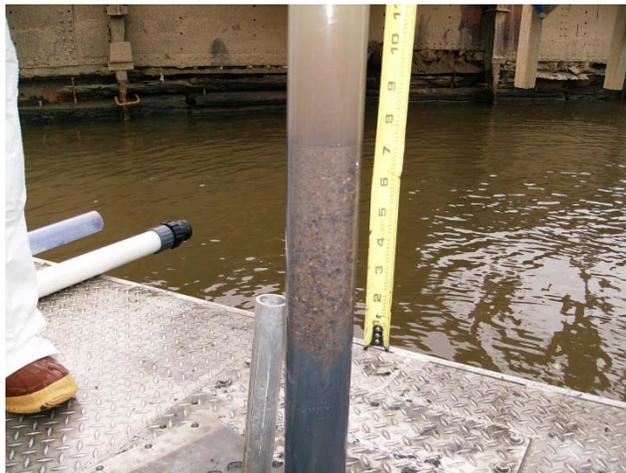


- **Patented Broadcast Capping System (BCS™)**

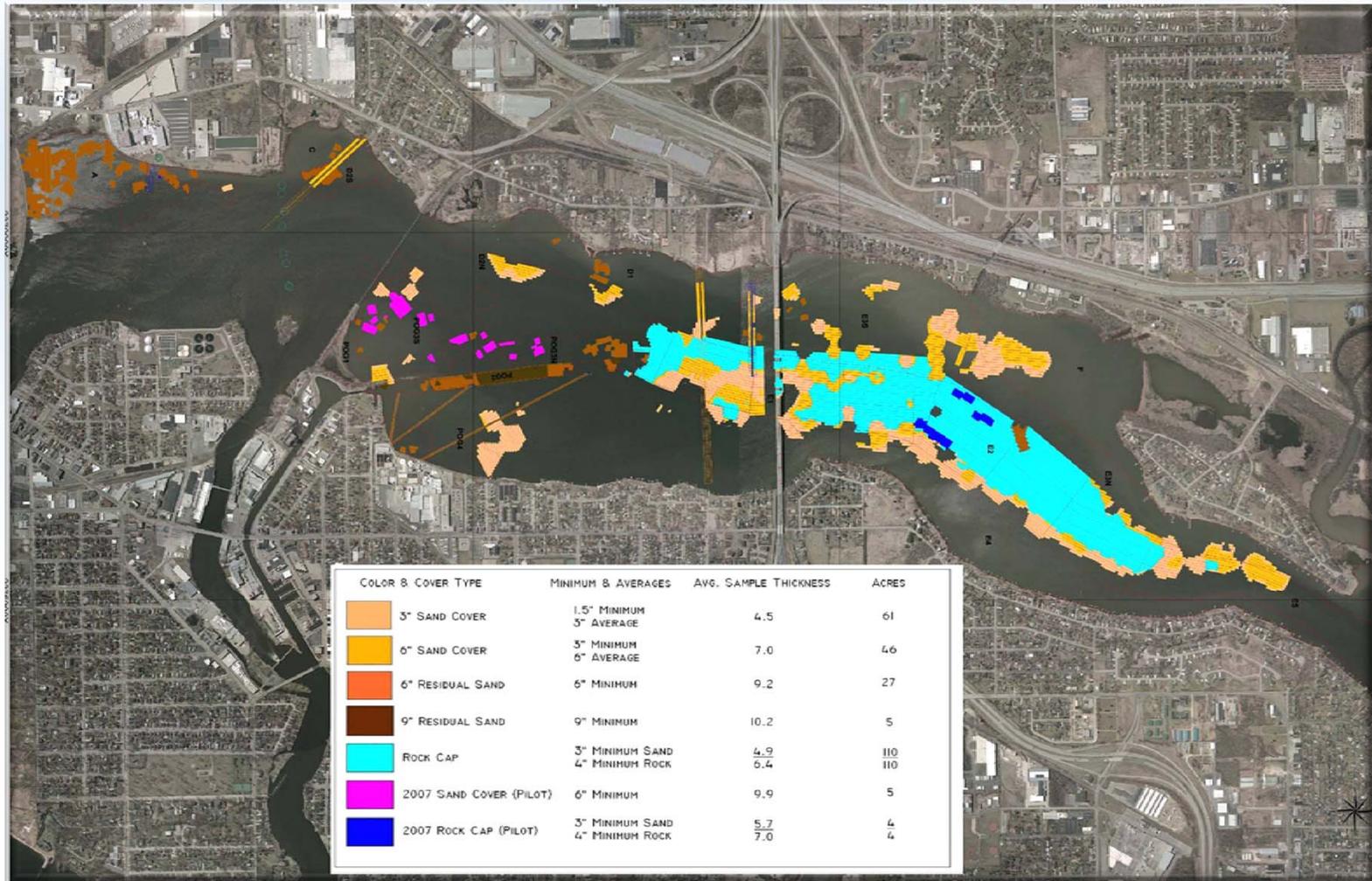
- Spreads material up to 3" in diameter
- Reduces intermixing of cap material with underlying sediments
- Precise, efficient placement

- **Mechanical Capping**

- Use of an excavator to place cap material
- Cost effective application
- Ability to place 3"+ diameter materials for armament



Sand Covers & Armor Cap Areas





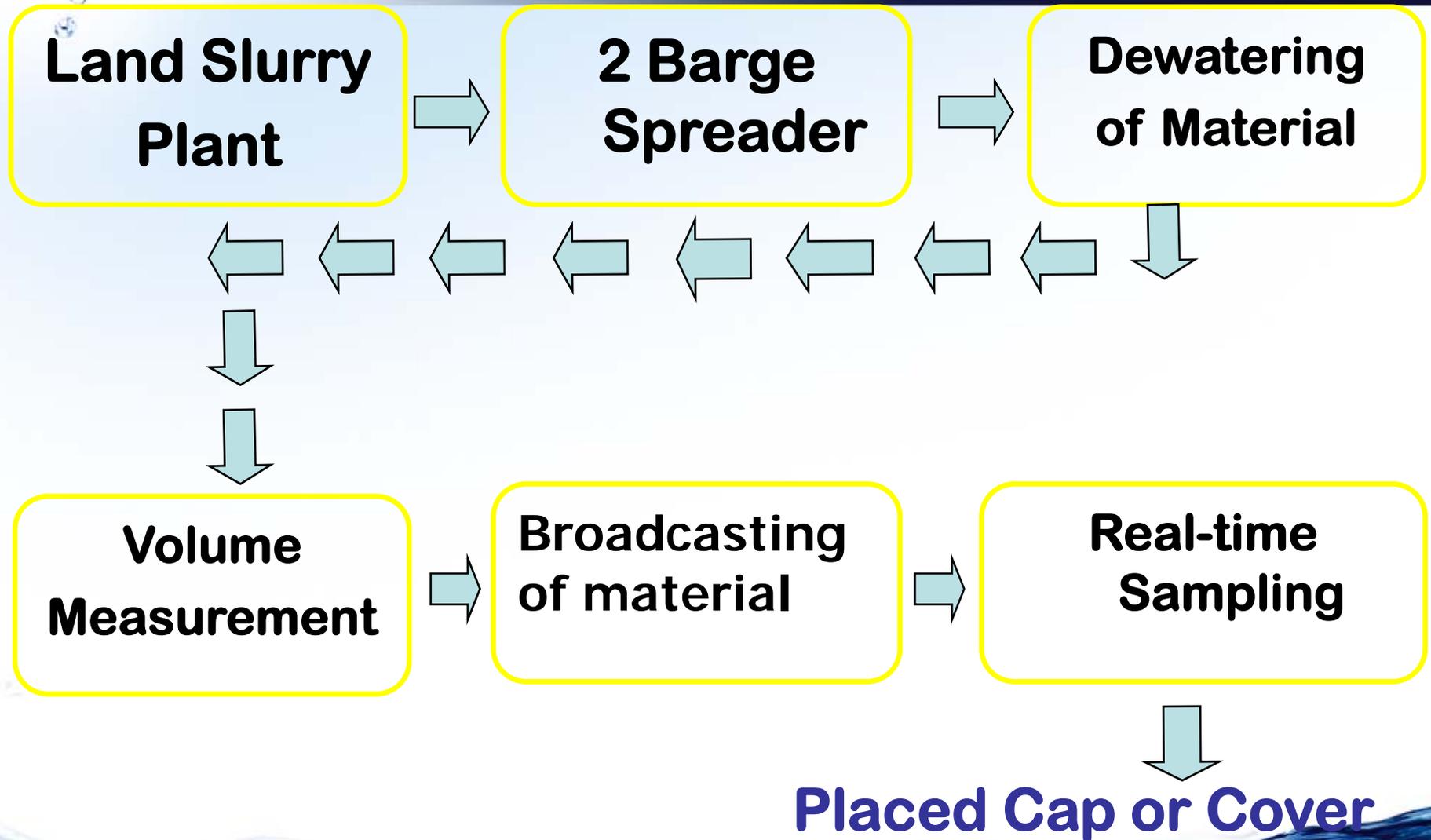
Brennan's Patented - (BCS™) System

- **Land Based Material Slurry Plant**
- **Broadcast Spreader**
 - **Allowed Shallow Access**
 - **Accurate Placement**
 - **Real-time QC/QA measurement**

BRENNAN

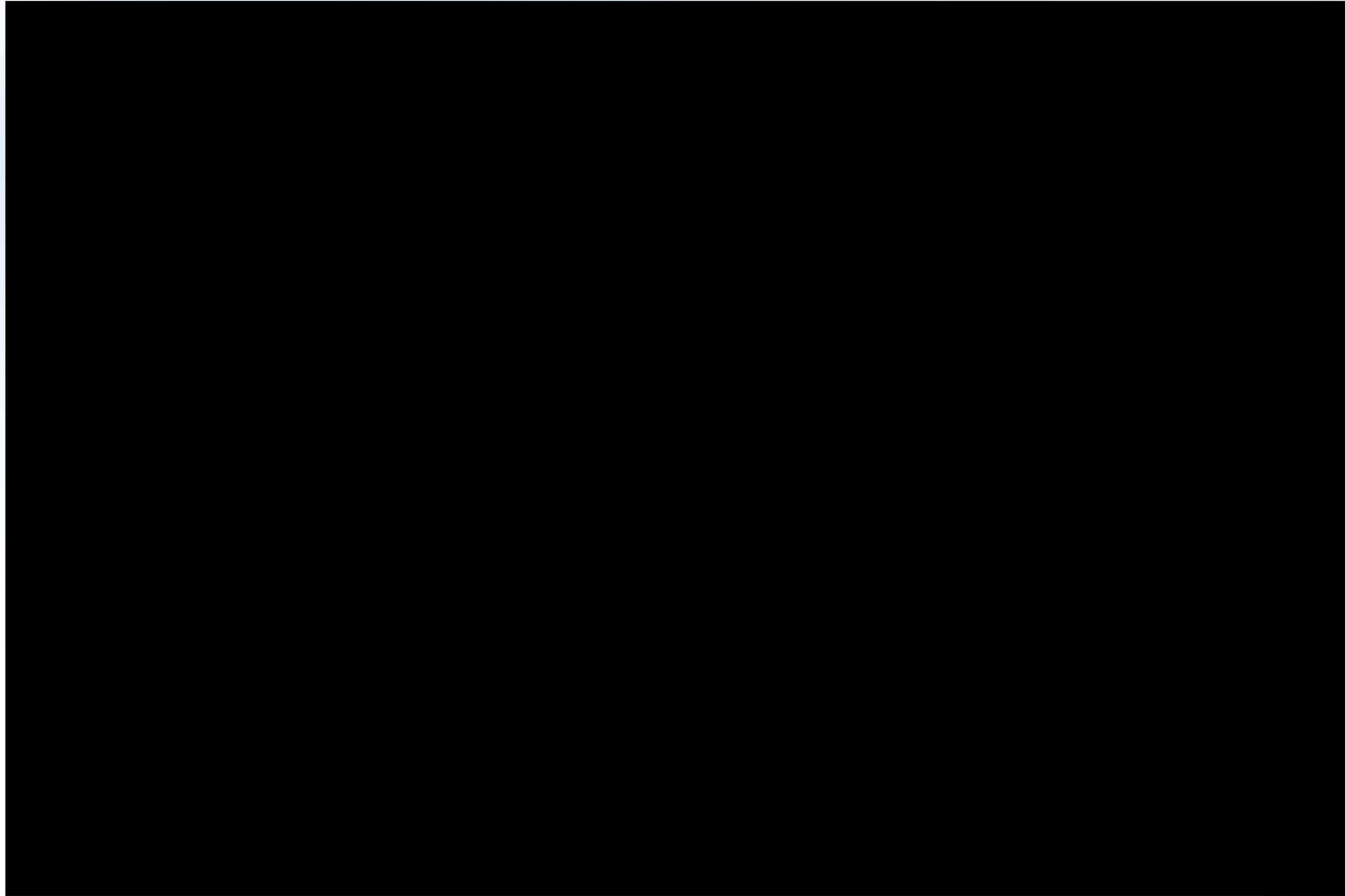


BCS™ 2 Phase System





Land based BCS™ Plants



Land Based BCS™ Slurry Plant - Controls

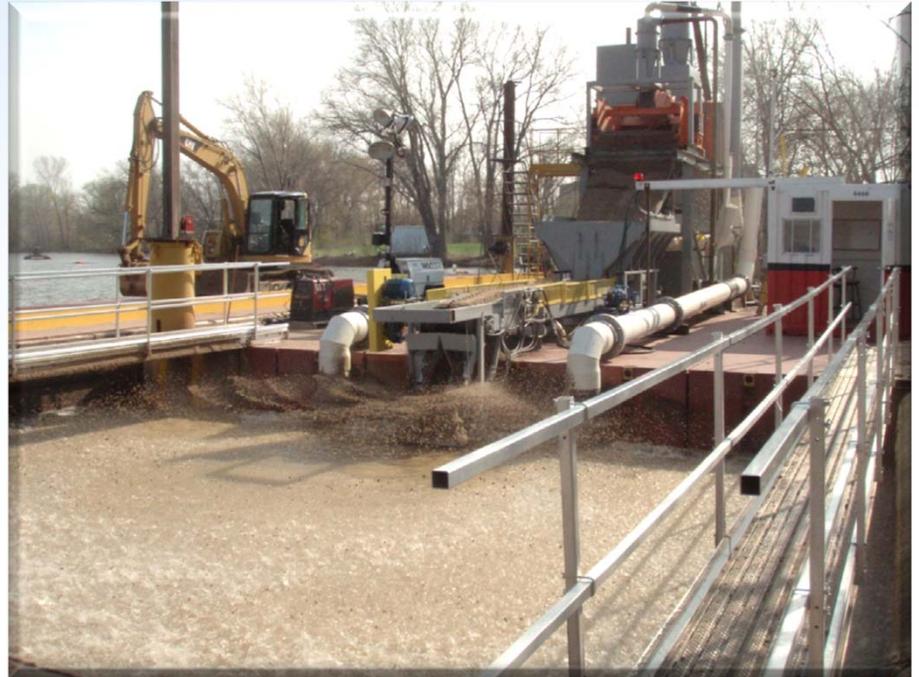
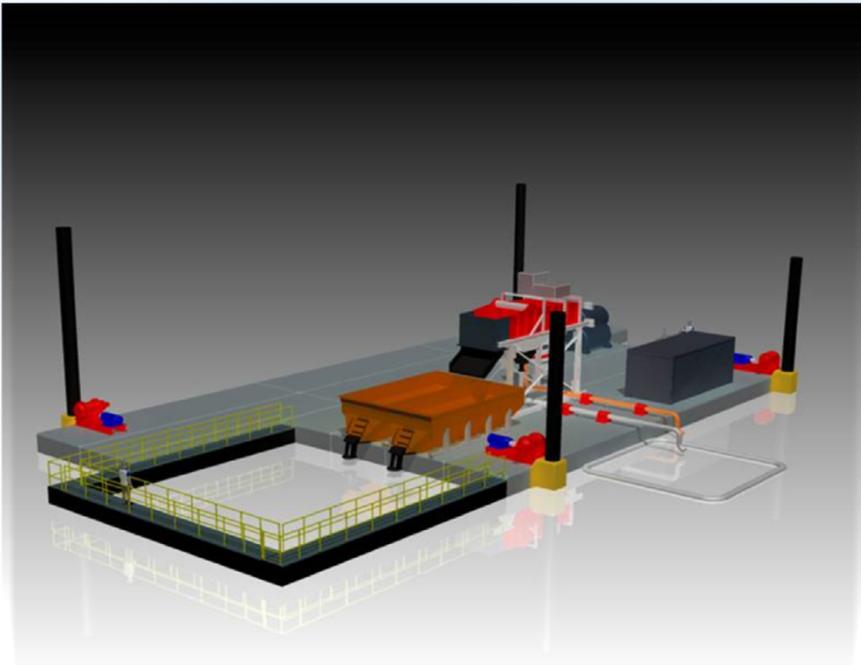
- **Bucket Count**
- **Belt scale on metering hopper**
- **RTK stock pile surveys**
- **Delivery tonnage tickets**



BRENNAN



Water Based – BCS™

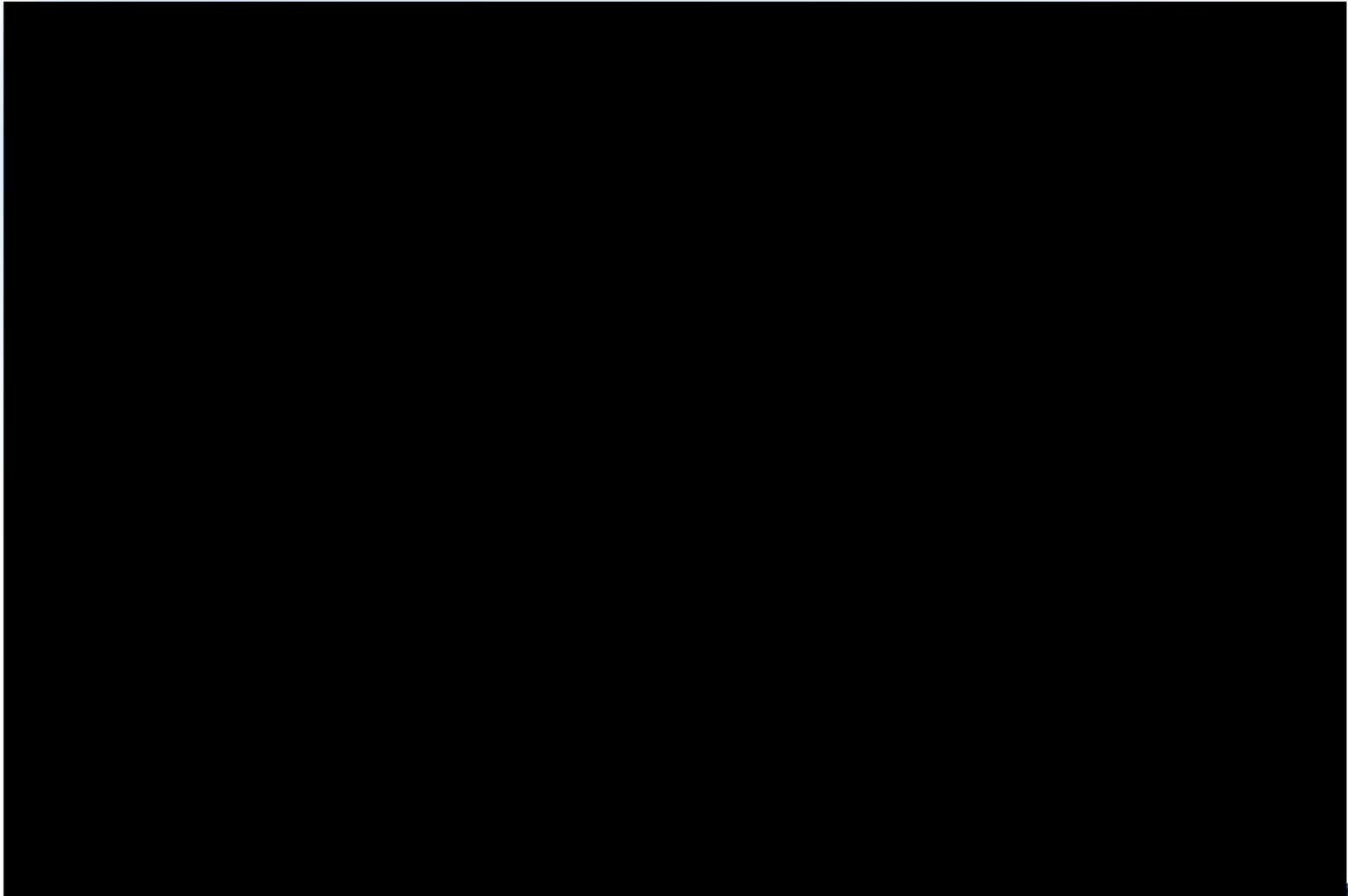


Two phase, fully automated broadcast capping systems > 900 acres





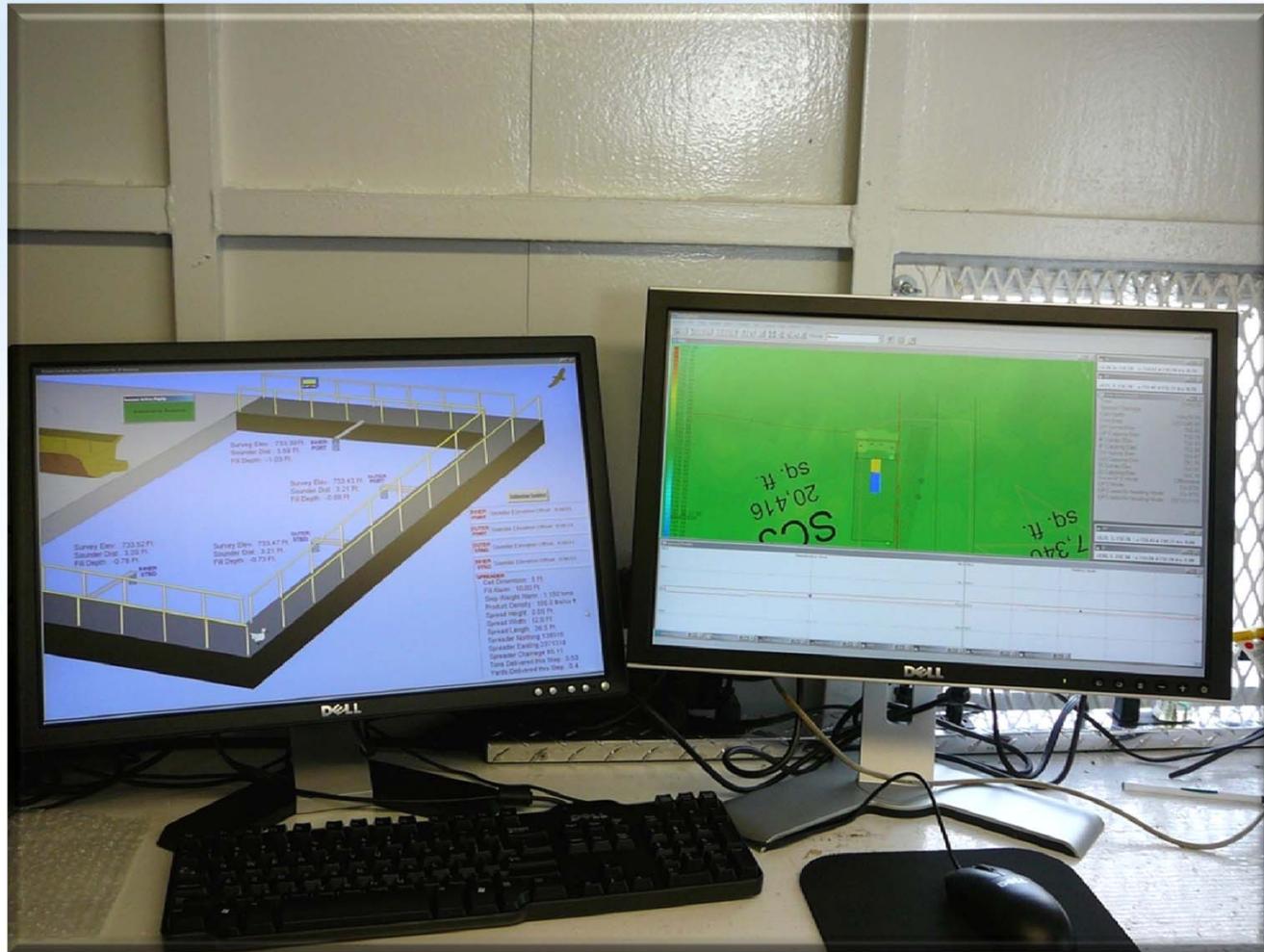
Water Based BCS™ Broadcast Distribution Plants



Overview of Capping— Movement of Plant & QC



Positioning & Accuracy Software



BRENNAN



Water Based – BCS™ Controls

- **Wonderware® software calculates tons and cy spread vs. required**
- **Alarm at 75% and 100% of the total volume spread**
- **Hypack® and RTK/GPS is used for positioning**
- **Steps from 6' for sand and 8' for gravel**
- **X,Y Positioning, time, tonnage, parameters, all stored in database**
- **Sampling within spreader bay**



BRENNAN

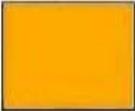
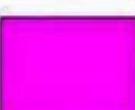
Capping Results

- **Minimal Mixing**
 - Less than 1”
- **Undisturbed Soft Sediment**
 - Reduced velocity placement
- **Increased accuracy**
- **Saved significant volume of cover material**



BRENNAN

Capping Results

COLOR & COVER TYPE	MINIMUM & AVERAGES	AVG. SAMPLE THICKNESS	ACRES
 3" SAND COVER	1.5" MINIMUM 3" AVERAGE	4.5	61
 6" SAND COVER	3" MINIMUM 6" AVERAGE	7.0	46
 6" RESIDUAL SAND	6" MINIMUM	9.2	27
 9" RESIDUAL SAND	9" MINIMUM	10.2	5
 ROCK CAP	3" MINIMUM SAND 4" MINIMUM ROCK	$\frac{4.9}{6.4}$	$\frac{110}{110}$
 2007 SAND COVER (PILOT)	6" MINIMUM	9.9	5
 2007 ROCK CAP (PILOT)	3" MINIMUM SAND 4" MINIMUM ROCK	$\frac{5.7}{7.0}$	$\frac{4}{4}$

Gravel Broadcast Spreading



BCS™ Gravel Spreading Quality Control



BRENNAN

BCS™

Blending Organoclay with Sand

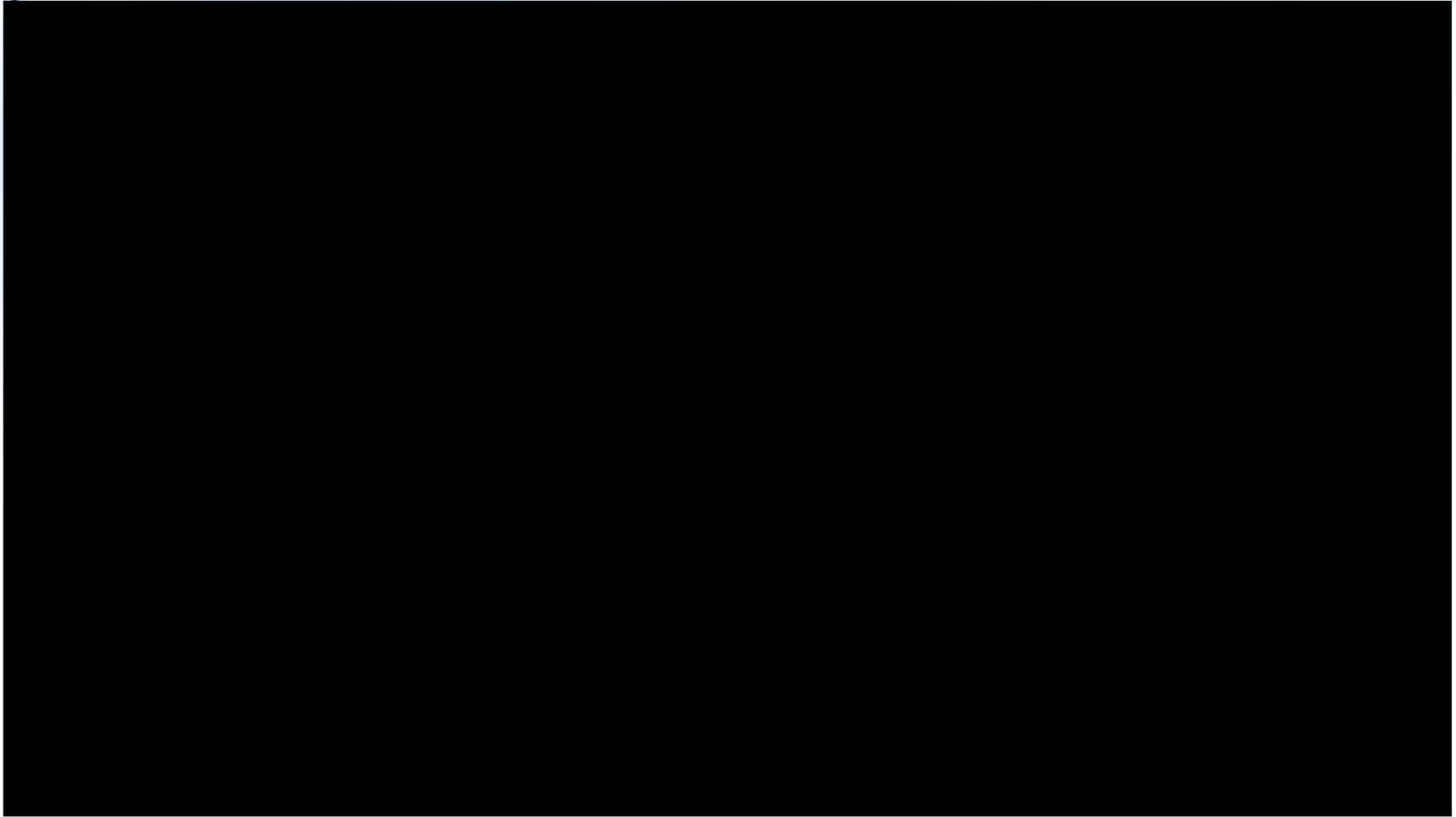
- **Wetland sand placement of 1.75' to 3' – fine fill sand**
- **Channel areas required**
 - **6" reactive layer – organoclay and fine fill sand**
 - **Top layer 12" sand and gravel mix**
- **Broadcast Spreader System - BCS™**
- **Combining Organoclay and Sand**





BCS™

Blending Organoclay with Sand



Rock Capping



Armor Capping



BRENNAN

A dynamic splash of clear blue water against a white background, with droplets and ripples extending across the middle of the slide.

BRENNAN

Marine Professionals Since 1919

WEDA Presentation

Safety Quality Efficiency